

DISEASES OF THE  
TESTICLE

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# DISEASES OF THE TESTICLE

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# DISEASES OF THE TESTICLE

## CHAPTER I

### THE DESCENT OF THE TESTIS

THE riddle of how and why the testes leave the secluded place of their origin and migrate to their vulnerable resting-place in the scrotum has continued to puzzle enquiring minds since the descent of the organs was described in 1762 by John Hunter.

Briefly the facts are these. The testes are developed just beneath the primitive kidneys (fig. 1). That they are primarily intra-abdominal organs is shown by the fact that their nerve supply comes from the tenth dorsal segment and their blood supply from the aorta at the level of the twelfth dorsal vertebra. Before their descent the organs are attached to the posterior abdominal wall by a fold of peritoneum—the mesorchium—and it is through the upper part of this fold that the spermatic vessels reach the testis. The organs commence their journey at the third month of foetal life; towards the end of the seventh month they pass through the inguinal canals. Testicular migration is not, as might be supposed, steadily progressive. On the contrary. If the positions of the testicles of a five months' foetus are compared with the positions of one of seven months, it is evident that in the younger embryo the gland lies near

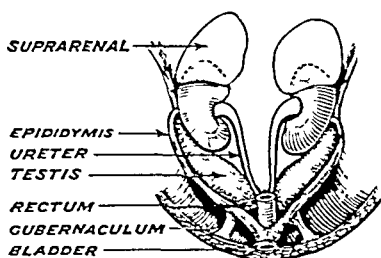


FIG. 1.—The relative positions of the kidney and the testicle in early embryonic life. (After Sir Arthur Keith.)

the inguinal canal while in the older embryo it seems to ascend a little into the abdomen

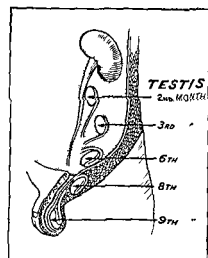


FIG 2 — The migration of the testicle. It should reach the scrotum shortly before birth

second year that their position in the scrotum becomes stabilised

At birth or shortly afterwards the terminus should be reached (fig 2). The right testis arrives usually some what later than the left

Clinical experience dictates that in a large number of normal infants the testes can hardly be said to be in the scrotum until towards the end of the first year. Even then at the least provocation they are drawn up into the inguinal canals by the cremaster muscles

It is not until about the

### THE GUBERNACULUM

Intimately connected with the later stages of descent is the formation of the gubernaculum. This unique structure consisting of actively proliferating cells with large ovoid nuclei appears at the third month of foetal life. It grows from the lower end of the mesorchium towards the inguinal region the part immediately below the testis at this time being bulbous. By the fifth month distinct fibres can be made out and the gubernaculum grows through the inguinal region together with the processus vaginalis. The gubernaculum reaches its maximal development at the seventh month (fig 3). These fibres are marked better in some animals than in man i.e. the hedgehog and Hunter seems to have derived many of his ideas from that animal

**The Processus Vaginalis.**—In the sixth month the processus vaginalis makes its appearance. This pouch is neither pulled down by the gubernaculum nor is it pushed down before the advancing testicle. It appears to be a true outgrowth of the peritoneum through the abdominal wall.

**The Function of the Gubernaculum.**—Latter-day embryologists have taught that the gubernaculum pulls, or by its atrophy drags, the testis down to the scrotum “like a log on

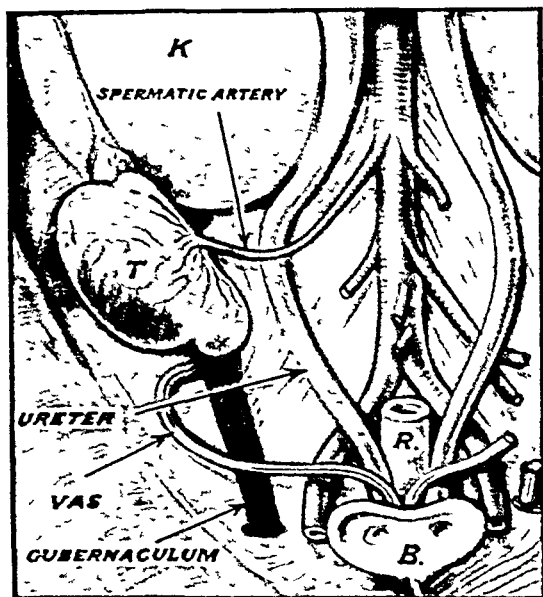


FIG. 3.—The gubernaculum. (After E. C. Hill.)

K, kidney ; B, bladder ; T, testis ; R, rectum.

a sledge.” This can be disproved by a simple experiment. If an incision is made in the inguinal canal of a new-born male subject it can be shown that the distal end of the gubernaculum is attached, not to the scrotum, but to the coverings of the testis : indeed, the testis within its coverings can be lifted out without tearing more than a strand or two of connective tissue (fig. 4). Without a fixed point upon which to act, it is inconceivable that the gubernaculum can in any way exert traction upon the testis : the force which expels the organ must therefore be sought elsewhere. It is prob-

able that the main function of the gubernaculum is as Hunter must have thought when he named the structure

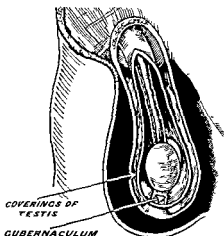


FIG. 4—Showing the fascial coverings of the scrotum in a newly born infant. Note that the gubernaculum is not attached to the skin of the scrotum. (After R. H. Hunter.)

gubernaculum (Latin = helm rudder) that it prepares the path for and steers the organ to its resting place

#### INTRA ABDOMINAL PRESSURE AS A FACTOR

Because during the later months of foetal life the gut enlarges and becomes distended with meconium it has been suggested that the intra abdominal pressure rises and by the eighth month this pressure is sufficient to squeeze the testes through the abdominal wall. This does not explain why the left testis descends somewhat before the right nor can it be regarded in other respects as a satisfactory hypothesis but it must be admitted that intra abdominal pressure may be a contributing factor to testicle expulsion.

#### HORMONIC INFLUENCES

The work of Lillie (1917) upon the free martin<sup>1</sup> proved that hormones influence the gonad even long before birth.

<sup>1</sup> When twin calves are of opposite sex the male is normal but the female twin is infertile and is known as a free martin.



Individual practitioners have noted that from time to time a retained testis has descended after the exhibition of pituitary extract. The rationale of this form of therapeusis appears to be founded upon attempts to treat dystrophia adiposogenitalis (Fröhlich's syndrome). In the latter disease some increase in the size of the testis has been noted after a course of treatment with pituitary extracts.

More recently it has been proved that descent of the testis is influenced profoundly by a hormone isolated from the urine of the pregnant female. Engle, in his studies of the anterior pituitary-like hormone of pregnancy urine, injected this into immature male apes. The testes doubled in size and descended. Conversely, Hisaw found that the administration of any ovarian extract to male pocket-gophers during the breeding season caused the testes to return to the abdomen.

Some success has been achieved in the treatment of maldescended testes by the administration of the gonadotropic hormone (see p. 21).

#### VARYING POSITIONS OF THE TESTES IN THE ANIMAL KINGDOM

The problem of why the testes descend at all is the more complex because testicular migration is not a constant developmental event throughout the animal kingdom. In creatures up to and including birds and reptiles, the testes remain in the upper part of the abdomen. The same condition persists in primitive animals such as the ornithorhyncus and the hydrax. Several fine animals high in the phylogenetic scale, such as the camel, the elephant, the ant-eater, the seal, and the whale, propagate their species with their testes normally in the abdomen or the inguinal region. In yet another group, of which the rabbit, the hedgehog, and the bat are prominent members, the testes only migrate to the scrotum during the breeding season.

#### THE FUNCTION OF THE SCROTUM

Amidst all this uncertainty one practical point stands out—in man, and those animals where the testis is wont to

descend, arrested descent is followed by arrested testicular development. In other words, with the advent of puberty, unless the testes are accommodated in the scrotum they fail to mature and function normally. Much ingenuity has been expended in explaining this phenomenon—what is the function of the scrotum, and how can this bag of skin have such a profound influence on the organ it contains? The most subtle theory attributes to the scrotum the property of a thermo regulating mechanism. The theory of testicular maturation in relation to temperature is well founded. There are numerous collaterals in zoological research. For example, Professor Meek demonstrated that reproduction activity is intimately related to temperature, and that the testes of perch increase and decrease in size according to the temperature of the water.

The supporters of the thermal theory state that, in order to increase and multiply, the cells of the external secretory mechanism of the testis must be kept at a temperature two or three degrees lower than the rest of the body. In the scrotum, and nowhere else, are these conditions to be found. I have taken the scrotal temperature of a number of patients in bed and compared it with the axillary temperature, the former has been one or two degrees lower. The scrotum contains no insulating fat. Only after the testes have been extirpated is fat deposited in the scrotal walls, the eunuch's scrotum is often well lined by adipose tissue. The Smith field butcher's test for prime beef is to cut into the ox's scrotum and the more the fat therein the higher the quality of the beef.

Carl Moore, of Chicago, insulated the scrotum of a ram with a kind of tea cosy. In a few weeks the testes became smaller, and in eighty days the organs were aspermatic. When the insulating material was removed, the ram regained its pristine activities. A series of experiments carried out by several independent observers are very convincing. By operation one testicle is placed in the abdomen in several adult dogs. The dogs are sacrificed after a period ranging from days to several months. Within a few months the

seminiferous tubules are lined only by a single layer of Sertoli's cells—all the germinal epithelium has atrophied. When the abdominal testis is replaced, within four weeks, regeneration of the external secretory mechanism takes place. After three months the power of regeneration is lost (Wangensteen). When the testis of a puppy is replaced in the abdominal cavity it undergoes but little change, becoming only slightly less plump than its fellow (J. Griffiths). The baneful effects of too high a temperature upon the testicle are strikingly in evidence only when the organ is mature.

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## CHAPTER II

### IMPERFECT DESCENT OF THE TESTIS

THERE are two varieties of imperfectly descended testicles

(a) **Maldescended** (*syn* **Incompletely Descended**).—The testis has been arrested in some part of its normal path of descent

(b) **Ectopic**.—The testis is placed outside the normal path of descent

#### ON THE CAUSE OF MALDESCENT

While so little is understood about normal descent, there can be little wonder that the reason for failure of the testes to reach the scrotum is a matter of speculation. John Hunter recognised that an incompletely descended testis of some standing was "exceedingly imperfect," and he considered that testicular imperfection was the cause of the maldescent. It will be shown conclusively (p. 9) that this theory is untenable, and that malformation is the result, not the cause, of maldescent. Obviously the fault must lie with the motive power or the passage, not with the passenger. Many theories to explain arrested descent have been promulgated, some of which are merely flights of fancy.

#### Theories

1 The gubernaculum breaks

2 Adhesions occur between the peritoneum and the epididymus or spermatic vessels. Some go so far as to ascribe these adhesions to foetal peritonitis

3 Arrested descent is due to congenital shortness of the spermatic vessels

4 Faulty position of foetus in utero causes abnormal pressure of the thigh against the inguinal canal, and prevents

complete descent (fig. 5). This theory, which was propounded by Philip Turner, appears to me to be the most feasible.

### HEREDITY AS A FACTOR

In veterinary practice the hereditary nature of maldescended testis is common knowledge. Every intelligent breeder of stock knows that a monorchid or cryptorchid stallion tends to sire colts with the same deformity. Breeders of

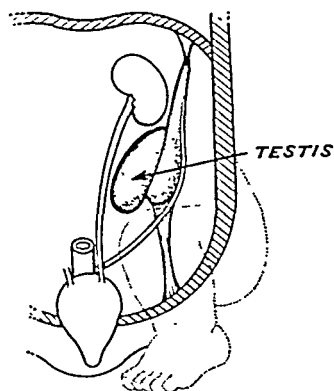


FIG. 5.—Malposition in utero may prevent the descent of the testis. (Philip Turner's theory.)

pigs tell the same story. It has been noted also, time and again, by those who rear pedigree dogs and cats. In rural England monorchid and cryptorchid beasts, known as the "rig" and the "will gill" respectively, are most unwelcome, for the value of the animals is depreciated so much that they may be unsaleable.

In man the hereditary factor is less in evidence. McAdam Eccles was unable to get a family history in more than 2 per cent. of his cases; on the other hand, some Continental observers have noted it fairly often in man. When estimating the frequency of the familial tendency, one must take into consideration that monorchidism and cryptorchidism in an individual is not brazened abroad.

### MORPHOLOGY OF THE MALDESCENDED TESTIS

Painstaking comparisons by many observers have proved that until shortly before puberty the maldescended testis and the normal testis are size for size, weight for weight, and histological appearance for histological appearance, almost identical.

From puberty onwards the maldescended organ differs, often remarkably, from its normal counterpart. Macroscopically the body of the maldescended testis is small and soft. The epididymis becomes separated from the body

(fig 6)—this is a constant operative finding when the testis lies in a patent processus vaginalis but curiously, when it is enveloped in a tunica vaginalis the deformity

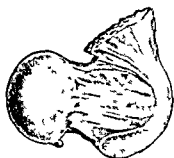


FIG 6—Typical deformity of a mal descended testis from a youth of 17. Separation of the body of the testis from the epididymis is more frequent in those organs situated within a patent processus vaginalis

is less marked. Sometimes there is wide separation of the epididymis from the body and exceptionally the body disappears (fig 7). It is almost as if Nature herself disappointed with her imperfect work wished to cast it down a Tarpeian rock (Edmund Owen). Malformation is most evident in testes arrested in the abdomen.

McFadyean examined microscopically twenty five mal descended testes from full grown animals and found that out of fourteen situated in the abdominal cavity only two contained spermatozoa. In testes which had been arrested in the inguinal canal he found a somewhat higher percentage of functional organs. Sir John Bland Sutton after careful observations extending over many years only once found spermatozoa in a mal descended testis. From these and other observations it can be shown that

the mal descended organ, especially one hidden entirely, while sometimes exhibiting transient spermatogenesis about the time of puberty, is to all intents and purposes functionless so far as its external excretory function is concerned. Sir Astley Cooper rightly taught that a man

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FIG 7—The evolution of anorchism. *a* normal testis. *b* and *c* separation of body from epididymis as seen in mal descended testis. *d* separation complete—the body is lost. (After Counsellor and Weekes.)

with bilateral maldescended testes was sterile, whereupon one of his pupils, a cryptorchid, left the room and committed suicide. At the necropsy which followed live spermatozoa were demonstrated. From these remarks it will be appreciated that it is unsafe to deny parentage to the cryptorchid. While spermatogenesis in the retained organ is transient and feeble, if it occurs at all, the internal secretory cells fulfil their function, and secondary sexual characteristics are manifest, although in the cryptorchid they are seldom well-developed. The scrotum of the cryptorchid often gives the appearance of being rudimentary (fig. 8). It is as though the testicle had sent a message to the scrotum saying it was not coming (Wangensteen). The spermatic vessels are always short, and generally bound down by fascial bands or adhesions, their length determining the level at which the testis lies. *Usually the length of the vas deferens is found to be normal.*

#### CLINICAL FEATURES OF MALDESCENDED TESTIS

It is necessary to emphasise an important definition. A maldescended testis is one which cannot be made to touch the bottom of the scrotum. In infant boys intermittent contraction of the cremaster pulls the testis into the inguinal canal for the time being. This has beguiled the clinician over and over again. I have had a large number of young boys with active cremaster muscles sent up as suffering from maldescended testes by competent practitioners. In a few of the cases it is really difficult to be quite certain.

If it is impossible to manipulate the testis into the scrotum the little patient should be examined immediately after, or during, a warm bath. When seeking a retained testis a light



FIG. 8.—A cryptorchid at puberty, showing the rudimentary scrotum.

touch over the upper part of the inguinal canal (especially when the patient is examined in the upright position) sometimes reveals a mobile tell tale swelling which up to that time had defied definition

From various recruiting boards statistics it is found that 3 per cent of candidates suffer from maldescent of the testis. Constant observation shows that in unilateral examples it is the right side which is affected more often. Probably this is due to the fact that the right testis passes through the inguinal region a little later than the left.



FIG. 9.—Maldescended testis at the external abdominal ring. (Lowsley and Arnott)

Cryptorchidism is said to be relatively rare. It has been estimated that unilateral failure to descend (fig. 9) is ten times more common. This has not been my experience; the bilateral examples have been nearly as common as the unilateral.

#### THE HAZARDS OF MALDESCENT

1 **Sterility**—The main disadvantages of cryptorchidism are obvious. For all practical purposes a cryptorchid is sterile.

2 **Nervous Disorders**—As the years of manhood approach stigmata of degeneration (fig. 10) are prone to develop. So often the boy who was bright and intelligent up to the age of puberty begins to lag. One-sided maldescent is not so frequently associated with stigmata, although neurotic disturbances are liable to follow (A. Goetsch). Persistent nocturnal enuresis was relieved in one case of Brunzema's by



scrotal replacement of a maldescended testis. Goetsch reported a similar case.

3. **Pain.**—A maldescended testis, particularly one situated in the inguinal canal, is liable to be painful. The pain usually comes on in attacks, and is due either to subacute torsion or to injury, to which an organ in this situation is liable.

4. **Torsion** occurs somewhat more frequently.

5. **Hernia.**—Approximately 75 per cent. of imperfectly descended testes are complicated by an associated inguinal hernia.

6. **Malignancy.**—Since 1851, when Le Compte suggested that the misplaced organ was more prone to malignant changes, controversy has raged around the question of maldescent in relation to malignant disease of the testicle. At



FIG. 10.—Boy, aged 14. Bilateral undescended testes. Stigmata of degeneration: bilateral ptosis, left internal strabismus, large ears, thick lips, feathered nose, etc. (A. Goetsch.)

last there appears to be no doubt that the maldescended organ is more liable to be attacked. It has been shown that maldescent occurs in only .3 per cent. of the male population, yet from the clinics the world over, when a series of malignant disease of the testis is reported, a considerable proportion of cases have occurred in maldescended organs. Cunningham, in 1921, from massed statistics showed that the incidence of malignancy in maldescended testes is fifty times more common than that occurring in normally descended testes. Scrotal replacement of the imperfectly descended organ does not appear to lessen the increased tendency of malignancy. Wangenstein has collected five instances in

the literature in which a malignant change has occurred in a maldescended testis some time after orchiopexy

**7 Inflammation.**—It is obvious that inflammation of a maldescended organ, particularly an intra abdominal organ is more serious than when the testis is present in the scrotum

Finally, maldescent of one or both testes is usually a bar to those who wish to enter the public services

### LATE DESCENT OF THE TESTIS

There is a widespread and deep rooted belief that if a young boy with maldescended testis is left alone the organ will drop into the scrotum at puberty This view is shared with the general public by many practitioners and a few surgeons I have encountered cases where a concomitant hernia has been treated by operation early in life, and the parents had been told to await the advent of puberty for the testis to descend—proof, indeed, of an implicit trust in the doctrine of late descent It is undeniable that occasionally late descent does occur In spite of being interested in this subject for a number of years, I have seen but two examples in which the testis descended after the third year In one of these, which occurred in a man of 23, the organ already was the seat of malignant disease References in the literature to this important subject are few In 1894 Tuttle recorded a case where the testis descended after an attack of gonorrhœal epididymo orchitis There then appears to be a long gap in the literature on this question, until we come to 1934, when C B Drake, a medical officer to a school, reported that he had seen late descent occur on several occasions It is impossible to gather sufficient data on which to base the expectation of late descent It is, however, evident that examples of patients and their hopeful parents waiting in vain are plentiful, and to wait until puberty is to rob the patient of his best chance of successful orchiopexy

### POST-OPERATIVE RETAINED TESTIS

Very occasionally, weeks or months after an operation for inguinal hernia the testis, which was in its normal posi-

tion previously, is found to be pulled up, usually just outside the external abdominal ring. I have met with three examples of this condition, which was referred to by Tyrrell-Gray. In each an operation for orchiopexy was undertaken with satisfactory results.

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## CHAPTER III

### ECTOPIC TESTIS

AN ectopic testis is one which is placed outside the normal path of descent. From time to time examples are encountered where the testicle is found in an unusual position. The following are the usual sites:

1 **Superficial Inguinal Ectopia** is the most common variety. The testis lies somewhere between the external abdominal ring and the anterior superior iliac spine superficial to the inguinal canal.

2 **Perineal ectopia** (fig. 11) was described in detail by Curling in 1841 and he reported nine collected cases.



FIG. 11.—Perineal testis.

3 **Femoral Ectopia**—

The testis lies in Scarpa's triangle. Only exceptionally does it reach this situation by leaving the abdomen via the crural canal. Authentic instances of this path having been pursued are recorded. Pannett, Macewen and Fauntleroy have each seen at operation upon a femoral testis the cord passing into the abdomen through the crural canal.

4 **Pubo-penile** (fig. 12)—The testis is placed at the root of the penis. This is the rarest situation.

Superficial inguinal ectopia is of considerable importance. Not only is it the commonest variety but it is very likely to be mistaken for maldescended testis. This differential

diagnosis is unimportant unless the patient is over puberty, in which case a better prognosis can be given in the case of the ectopic testis, which has a comparatively long cord.

**Ætiology.**—C. B. Lockwood, in his Hunterian oration of 1886, explained the occurrence of a testis outside the path of its normal descent by the following masterpiece. About the fifth month of foetal life the gubernaculum spreads out in a fanlike manner. By the sixth month a thick vesiculus passes onwards to the perineum; often another prolongation passes to Scarpa's triangle. In all, six digitations are to be found (fig. 13). In the human foetus the best developed digitation is the scrotal, and it is along this path that the testis proceeds normally. In the foetal pig the gubernaculum's largest digitation can be traced to the perineum, where the boar's testis usually is situated. Clinically an ectopic testis is found at one of the termini of the accessory gubernacular digitations.

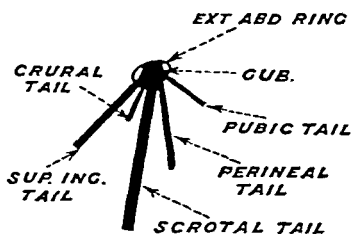


FIG. 13.—The "gubernacular tails" of Lockwood.



FIG. 12.—Pubopene ectopic testis. (After J. A. C. Forsyth.)

Even taking into consideration the inspiration he must have had from Hunter and Curling before him, the "many gubernacular tails" of Lockwood is one of the prettiest theories ever to be put forward to explain a surgical conundrum; it is what one might have expected of Lock-

wood's nimble brain. Whether his theory is wholly, or even in part, correct is not for me to say. S. G. Sonneland has been unable to find corroborative evidence, either embryological or anatomical, of the multiple gubernacular processes. A. Lee McGregor, by an extremely thorough piece of anatomical research on "the third inguinal ring," has shown that abnormal fascial pockets and ridges

exist in the inguinal region sufficiently often to account for ectopia of the testis on anatomical grounds without invoking the aid of the multiple gubernacular tails

**Clinical Features.**—An ectopic testis often develops quite well. Owing to its abnormal situation it is very liable to injury. Of necessity, many ectopic testes have a comparatively long spermatic cord, and on this account they are placed readily in the scrotum by operation at any age. In short, ectopic testis is usually a comparatively simple and eminently satisfactory condition to treat

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## CHAPTER IV

# THE TREATMENT OF IMPERFECTLY DESCENDED TESTES

### OLDER VIEWS

TWENTY-FIVE years ago Mr. Jacobson, whose indications for operation are always instructive and refreshing, while himself advocating earlier operation, stated that most of the French surgeons advised deferring surgical interference until the age of about 16. The teaching of the old masters seems to have taken root in Britain. Let us examine the results of this practice. If ten cases of maldescended testes are operated upon above the age of 15, seven are likely to be failures because usually by this time it is impossible to free the constituents of the spermatic cord sufficiently to bring the testis down without tension. Such a high percentage of failures naturally brought orchiopexy into disrepute, and the hand of ultra-conservatism appeared to be strengthened. Even the possibility of a successful orchiopexy was questioned; speaking of the operation in 1910, Sir John Bland-Sutton stated that surgical efforts to preserve a retained or partially descended testis could be described as pure supererogation.

A few years later it came to be realised that the disappointments of orchiopexy were due largely to delay in performing the operation; because now and again an inguinal testis descended at puberty on its own initiative hundreds of patients were being robbed of their chances of a successful replacement of the organ. The pioneer work of Arthur Dean Bevan, of Chicago, was commencing to diffuse, and surgeons interested in the deformity were unanimous in advising a much earlier operation. The extreme in this respect was reached by Harrenstein, who recommended

operating soon after birth. The difficulties of freeing the minute spermatic vessels without injuring them and the doubtful advantages of performing an operation on one so young proved, on the whole, a somewhat retrograde step.

Orchiopexy has now rightly established a place for itself. There are still a few surgeons who stubbornly refuse to accept it as a feasible proposition. A favourite jibe is "how possibly can a congenitally short spermatic cord be lengthened?" I had been reflecting on this when a young man came to operation with an exceptionally large inguinal hernia, which he said he had noticed first eighteen months previously.

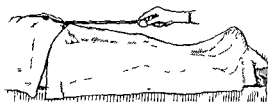


FIG. 14.—After the hernial sac had been removed the elongated spermatic cord allowed the testis to be placed upon the patella.

When the sac had been removed it was found that the testis could be placed upon the patella (fig 14). Presumably in eighteen months the cord had lengthened about 18 inches.

### THE PILLARS OF SUCCESSFUL TREATMENT

Up to the ages of 11 or 12 the chances of correcting the deformity are great. *The optimum time for performing orchiopexy is probably between the seventh and eleventh years.* If the testes are hidden entirely, the younger age should be chosen. Following these principles together with refinements in technique results of the operation of orchiopexy have improved steadily. For instance, in a follow-up of 147 cases Burdick and Coley found 123 had been successful. Undoubtedly the greatest factor in this remarkable advance is due to abandoning the old practice of awaiting Nature's pleasure at puberty. Another important contribution has been an understanding that a successful



operation depends not so much upon this or that method of fixing the organ in the scrotum, as attaining an adequate length of the cord without undue tension. The technicalities of the latter will be discussed fully later.

**Endocrine Therapy.**—The endocrine treatment of maldescent promises well. At any rate, it should eradicate the last traces of argument in favour of a policy of waiting—waiting until it is too late. If maldescended testes do not descend under endocrine therapy, it is inconceivable that they will do so by waiting longer.

A. W. Spence and E. F. Scowan injected 500 rat-units of pregnyl (organon) intramuscularly twice a week into 33 patients. Of 19 unilateral cases satisfactory descent occurred in 9. Fourteen patients had bilateral maldescended organs. Both testes descended into the scrotum in 6 patients, and one testis in 4 patients.

After the first, and sometimes after the second injection, there is usually a local reaction around the site of the injection. More rarely, a general reaction has been observed, incapacitating the patient for a day.

How long the injections should be continued in the hope of a successful issue has not yet been determined. It will depend upon circumstances, but in general, if no results have been obtained after a dozen injections, it would seem wiser to advise operation.

#### MANAGEMENT OF A CASE OF MALDESCENT

**The Patient is Seen at an Early Age.**—Below the age of 6 the parents should be told to watch for descent and to bring the child up for a periodic examination. A concomitant inguinal hernia is an indication for early herniotomy, and at the same time the testicle should be placed in the scrotum, preferably by Ombrédanne's operation. When there is no hernia and no symptoms referable to the maldescended testis, the best results will accrue from waiting until the ages of 6 or 7. About this time one or two months' treatment by injecting 500 rat-units of pregnyl twice a week can be tried if the parents so desire it. One should bear in mind

that the repeated injections are more painful than orchiopey. I have noted repeatedly that even highly strung children do not complain of pain after the operation.

**The Patient is not Seen until Puberty or Later.**—After the age of 12 the chances of bringing down the testis grow smaller. By the sixteenth year they fade perceptibly, but this does not imply that an attempt should not be made.

**Ectopic Testes.**—All ectopic testes should be submitted to operation, because the adequate length of the spermatic cord renders scrotal replacement usually possible, even if the patient is fully grown.

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## CHAPTER V

### ORCHIOPEXY<sup>1</sup>

**Multitudinous Methods.**—There is hardly an operation of surgery where there are so many different methods of performance as that of orchiopexy. In 1912 Hofstätter was able to list more than twenty operative measures. Since then half as many again have been added to the list. When one examines the various methods critically, it is clear that the main variations rest in the manner in which the organ is, as it were, splinted in the scrotum.

As far as scrotal fixation is concerned, the various techniques involved can be summarised as follows.

1. Fixation of the testis to the fundus of the scrotum, combined with a purse-string suture of the neck of the scrotum.

2. Traction applied by a stitch passing from the tunica albuginea through the scrotum and attached to the thigh or a wire cage.

3. Trans-scrotal implantation.

4. By an intra-scrotal temporary splint using the pubis as the fulcrum.

5. By implanting the testis into the thigh temporarily.

In this treatise no attempt will be made to describe all, or even many, of the thirty-odd operations. With so many methods from which to choose, those with an obvious disadvantage can be eliminated at once. Any method which necessitates a tractor passing through the scrotum leaves an avenue through which infection can enter—it is an “open” as opposed to a “closed” operation.

As a result of studying this subject, I feel that far too much

<sup>1</sup> Orchidopexy is etymologically incorrect (Torek).

attention has been directed to the fascinating ingenuity displayed in *testicular reposition* and much too little to the more difficult mobilisation which renders the testicle with an intact blood supply capable of being placed in the scrotum

The common factor to all methods showing a large measure of success is careful and thorough mobilisation particularly of the spermatic vessels

We will proceed at once to consider the fundamental principles of successful orchiopexy

### THE OBSTRUCTING AGENT TO SCROTAL REPLACEMENT

The Spermatic Vessels are usually the obstructing agent



FIG 15.—Showing the curved course taken by the spermatic vessels. By mobilisation they can be made relatively longer (dotted line) (After D Browne)

Their careful dissection from the retroperitoneal tissues for a considerable distance allows an organ to be brought down (fig 15) when before such a dissection the proposition seemed hopeless. There is abundant evidence that the nutrition of the testis is dependent upon the integrity of the spermatic vessels yet in some current text books and works on operative surgery it is stated that in cases of difficulty these structures may be divided<sup>1</sup>. Unless this teaching is eradicated entirely the prestige of orchiopexy is bound to suffer for once the spermatic vessels are damaged

seriously atrophy of the body of the testis follows as surely as night follows day

(For Anatomy of the Spermatic Vessels see p 47)

**The Coverings of the Cord**—The intercolumnar cremasteric and infundibuliform fasciæ are undoubtedly important obstructing agents in most cases. Over and over again intelligent division of these fasciæ in the neighbourhood of

<sup>1</sup> This disastrous idea arose through a misunderstanding of A D Bevan's early work on orchiopexy. Division of the spermatic vessels was even called by some Bevan's Operation much to that pioneer's indignation.

the internal abdominal ring enables the testis to be brought down without tension.

**The Vas.**—It is exceptional for the vas to be the principal obstructing agent; usually this structure is of ample length. Division of the fold of fascia in near relation to

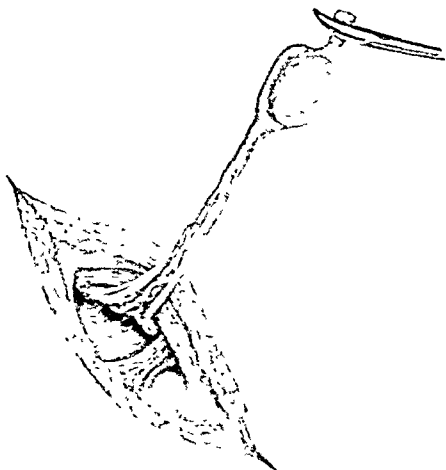


FIG. 16.—There is a fold of fascia on the upper aspect of the deep epigastric vessels which, when divided, usually frees the vas. Only occasionally is it necessary to divide the deep epigastric vessels. (After D. Browne.)

the vessels (fig. 16) is nearly always advisable—usually the deep epigastric vessels themselves do not obstruct mobilisation of the vas. In two cases in particular, I noted that division of the deep epigastric vessels, with consequent freeing of the vas, made all the difference in obtaining a cord of adequate length.

### THE OPERATION

**Preparation of the Skin.**—Iodine irritates the scrotum; for these cases thorough preparation with picric acid is advised.

**Bilateral Maldescended Testes.**—It is never advisable to operate on both sides at the same time. It is quite enough to complete this delicate dissection on one side, and to leave

the other for three or four months. The side adjudged to contain the testicle at the higher level, i.e. the more difficult side, is chosen for the first operation.

**Technique.**—The incision is similar to that for inguinal hernia, though it is somewhat larger (fig 17). The inguinal canal is opened by incising the external oblique, and nearly always the testicle is found easily if it has not been encountered before this step. The distal attachment of the testicular coverings, i.e. the remains of the gubernaculum, is found and freed. So firm is this

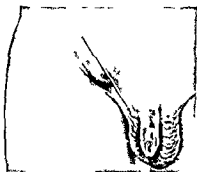


FIG 17—Incision for orchiopepy  
(After A. D. Bevan.)

attachment that, as often as not it is necessary to divide it between ligatures (fig 18). The testis in its coverings can now be lifted up, and the latter are separated by gauze dissection, aided by a touch or two of the scalpel, as far as the internal abdominal ring (fig 19).

One now prepares for a delicate dissection lasting from half to three quarters of an hour. Gentleness is the keynote of success. To be seated, rather than to stand, is to many operators an advantage, a difficult orchiopepy is one of those occasions where the surgeon needs iron patience and plenty of time.

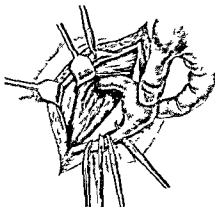


FIG 18—Division of the remnant of the gubernaculum

The coverings of the cord are incised for about an inch near the internal abdominal ring. The intercolumnar, cremasteric, and infundibuliform fasciæ are separated by blunt dissection, using a Watson-Cheyne dissector. The processus vaginalis is sought, and one of two types, each requiring somewhat different handling, will be encountered.

(a) The processus vaginalis takes the form of a hernial sac; sometimes it is quite small.

(b) The testis and its cord are virtually contained in a patent processus vaginalis.

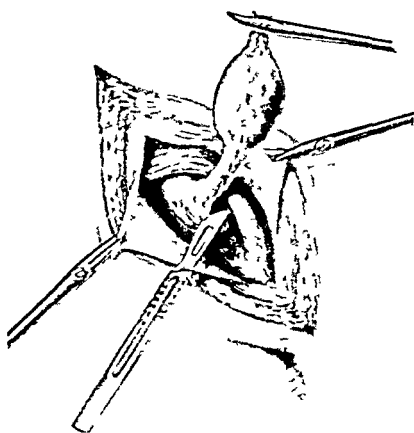


FIG. 19.—The cord in its coverings is dissected as far as the internal abdominal ring.

#### **The Processus Vaginalis takes the Form of a Hernial Sac.—**

The hernial sac is dissected free and opened, its mouth being held in hæmostats and drawn upwards. The coverings of the cord are severed piece by piece, after having made tense and spread out each moiety in order to be quite certain it is only fibrous or muscle tissue which is being cut. I find the best method is to use a pair of Mayo's scissors, and to lift up the strand of tissue on to the cutting surface of one blade near the tip, while traction is exerted in the long axis of the cord by dissecting forceps on the particular strand of tissue which is receiving attention. In the case of muscle fibres and most of the fibrous tissue, division is accomplished without employing a snip of the scissors. This process having been carried out on either side of the longitudinal incision in the coverings of the cord will soon bring into full view the spermatic vessels running from the back of the cord to the back of the peritoneum. On the medial side the vas can be seen parting from its companions (see fig. 16). It should be noted that, at any rate at this stage of the

dissection the cord is not denuded of its coverings only sufficient of the coverings is teased apart and severed to display the vessels clearly. The mouth of the peritoneal sac is lifted up by the attached hæmostats (fig 20) which are handed to the assistant. The testicle is wrapped in a warm moist swab and traction is applied to the cord. Attention

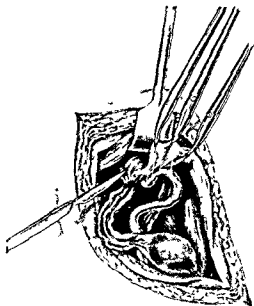


FIG. 20.—The hernial sac is lifted up and separation of the spermatic vessels from the peritoneum is commenced.

is focused on the posterior wall of the peritoneum. The all important freeing of the spermatic vessels is commenced. This is accomplished for the most part by sharp dissection, the vessels being freed from fibrous bands which bind them to the peritoneum. The conjoint tendon is retracted, this permits the vessels being freed for quite a distance. Attention is then directed to the vas and the



fascial bands on the lateral side of the deep epigastric vessels are divided. The time has arrived for the first "trial"—one endeavours to put the testicle in the bottom of the scrotum, or rather where this point would be. The scrotum is stretched with the finger (fig. 21), and the position of the tip of the finger is noted on the towels which cover the scrotum. Will the length of the cord allow the testis to come to this point? is the question. Usually, it will not. Attention is focused first on the vas. If, as is rarely the case, the deep epigastric vessels are an obstruction, they are divided between ligatures: more often it is the coverings of the cord which require attention—more tissue must be teased apart and divided at the level of the internal abdominal ring. Piece by piece this division goes on—further "trials" are made.

Providing the vessels have been mobilised as high as can be reached



FIG. 21.—Making a bed for the mobilised testis by stretching the contracted scrotum.

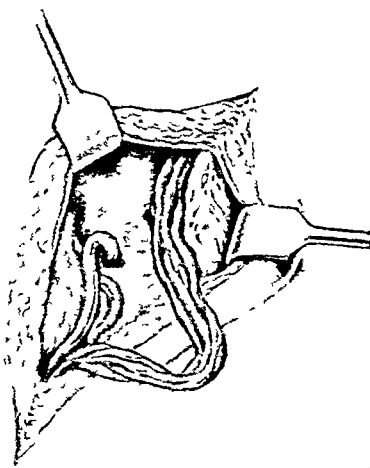


FIG. 22.—Division of the conjoint tendon is required occasionally in order to mobilise the spermatic vessels sufficiently. An alternative is shown in Figs. 23 and 24.

by retraction of the conjoint tendon reasonable division of the coverings of the cord in the neighbourhood of the

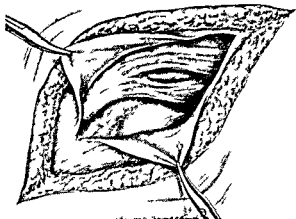


FIG 23—Buttonholing the internal oblique in order that the spermatic vessels can be mobilised at a higher level (After I a Roque)

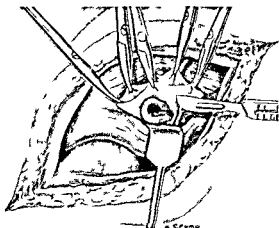


FIG 24—Dissecting the spermatic vessels from the peritoneum (After I a Roque)

internal ring is enough to free the testis sufficiently for it to be placed in the scrotum without tension in approxi

mately 85 per cent. of cases. In the remainder more length is required, and in perhaps a further 12 per cent. it can be obtained by one or more of the following measures.

(a) If the obstructing agent is the coverings of the cord, they must be denuded—leaving practically only the vessels.

(b) If the obstructing agent is still that the vessels are too short, they must be cleared to a higher level. This necessitates division of the conjoint tendon (fig. 22) or button-holing the internal oblique (figs. 23 and 24), which has been practised by La Roque.

(c) If the obstructing agent is the vas, division of the deep epigastric vessels is all that is required.

In a very few cases the cord is still too short. Providing one has not got exasperated prematurely—this will appertain only very occasionally in older boys or men—scrotal reposition must be abandoned in favour of:

1. Orchiopexy by stages (p. 41).
2. Orchiocœlipexy (p. 42), or
3. Orchidectomy.

By patient and intelligent dissection testicular mobilisation is possible in 95 per cent. of all cases below the age of 15. If the testis can be placed in the scrotum without undue tension, it is kept there by one of the three methods to be described in the next chapter. Having fixed the testis in position, the inguinal canal is reconstituted over the cord, as in inguinal herniorrhaphy.

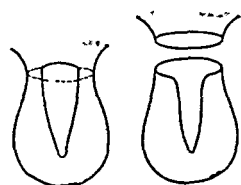


FIG. 25.—Making a "false neck" to the hernial sac.

**The Testis and its Cord are Virtually Contained in a Patent Processus Vaginalis.**—This variation makes the dissection somewhat more

difficult. The processus vaginalis is opened, displaying the testis. The next step is to invoke the principle of making a false neck to the hernial sac (fig. 25). The point at which this is done is just below the internal abdominal ring. It is a mistake to try to separate the delicate peritoneal process more distally, for about half an inch below the

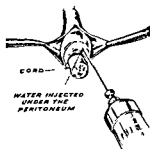


FIG 26

and hereafter orchiopepy differs in no respect from what has been described already

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internal ring it is very intimately blended with the cord. To inject fluid (I use 1 per cent novocaine) under the peritoneum (fig 26) makes the separation easier. The dissection is commenced at either side and the peritoneum is lifted off the cord with a Watson Cheyne dissector. Once it is free, the peritoneum is divided and the proximal edge is caught in hæmostats. A false neck has been constructed,

## CHAPTER VI

### ORCHIOPEXY (*continued*)

**Methods of Retaining the Mobilised Testis in the Scrotum.**—Three methods will be detailed.

#### TRANS-SEPTAL IMPLANTATION

**Evolution of the Operation.**—The principle appears to have been conceived by the French surgeon, C. Walther, in 1906. L. Ombrédanne, the well-known authority on children's surgery in France, has perfected the operation, and he and his assistants have operated upon nearly 1,000 cases using this method. P. Turner, of Guy's Hospital, has popularised the operation in England. As far as can be judged by published accounts, the method is not employed often outside France and England.

**Special Indication.**—This appears to be the most satisfactory method when orchiopexy is undertaken very early

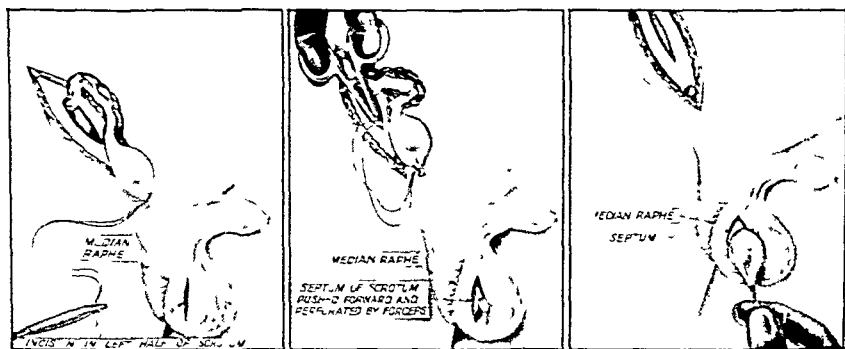


FIG. 27.—Trans-septal implantation. (Ombrédanne's operation.)

in life, i.e. under the age of 5 or 6. An advantage claimed for the method is that in cases where the cord is short the septum is brought up to the testicle, thus rendering orchiopexy possible in all cases.

**Technique.**—A catgut stitch is attached to the stump of

the gubernaculum. The covering towels are removed and more picric acid is dabbed on the scrotum. Assuming it is the right testis which is to be transplanted, an incision is made to the left of the median raphe, and the left compartment of the scrotum is entered (fig 27). During this and the subsequent stages of the operation Ombredanne recommends that each extremity of the scrotal raphe be grasped in toothed forceps, and held so as to stretch and steady the mid line of the scrotum. After pushing a finger from the inguinal wound into the empty half of the scrotum, a long hæmostat is passed along the same path and its nose is made to pierce the scrotal septum, which is recognised by its white colour. By this means the stitch attached to the testis emerges from the scrotal wound. By pulling on this stitch the testis is brought to the septum, and it is manipulated through the incision in the septum. The incision in the septum is, of course, stretched to allow the testis to come through, but it should be a tight fit. The



FIG 28.—Relative positions of the testes when both sides require orchiopexy. Note the second testis below the first.

right testis now lies in the left half of the scrotum. The incision in the septum, which transmits the cord, is narrowed by a stitch. Care must be exercised to make this closure sufficiently tight to prevent escape of the testicle but not tight enough to cause strangulation of the cord. Ombredanne does not advise catgut for this suture, as it may be absorbed too rapidly and allow the testicle to escape. Thread or fine silk should be employed. The scrotal and inguinal wounds are closed. After the operation, it will be observed that the scrotum is pulled up by the trans-

planted testis, but gradually it falls, and at the end of three weeks it should be dependent.

**Bilateral Cases.**—Following the usual rule, only one side is attended to at a time. In the second operation it is necessary to pass *below* the testis previously fixed, for at this point the second testis can have the pull on the septum

it requires for the first few weeks without interfering with the first testis and its cord (fig. 28).

**Results.**—In a series of cases investigated by P. Turner, 14 per cent. were pronounced failures. In the remainder the results were excellent.

**Criticism of the Method.**—Dr. Torek, in a discussion on the subject, said that trans-septal implantation fails to bring the testis to the bottom of the scrotum, and if the testis should become gangrenous there is a danger that the sound organ will be destroyed.

### TEMPORARY IMPLANTATION INTO THE THIGH

**Evolution of the Operation.**—On April 16, 1894, C. B. Keetley, Surgeon to the West London Hospital, described this method to the Medical Society of London. In the *Lancet* of July 29, 1905, Keetley illustrated the method with a photograph of a patient on whom he had operated. The photograph shows the scrotal tunnel perfectly. In 1908 the method was described by C. Torek in America. The operation was not taken up to any extent on either side of the Atlantic until 1926, when H. Willy Meyer, a colleague of Dr. Torek, read a paper before the New York Academy of Medicine on the subject. He described the results of sixty-four cases operated upon by the method at the Lenox Hill Hospital. The operation has since been called Torek's operation, not, I feel sure, by any wish of Dr. Torek. The Keetley-Torek operation it was called in Johnson's *Operative Therapeutics*. This is fair to Keetley, and emphasises the part played by Dr. Torek in perfecting and popularising the operation.

Preparation of the skin of the area must be thorough. The folds of the groin and the scrotum require scrupulous cleansing. While the Keetley-Torek operation can be described justly as a "closed" operation, it cannot be performed from start to finish with the skin covered entirely. The possibility of infection, though small if the skin preparation is perfect, and the necessity for a second operation, though trivial, are its disadvantages.

**Technique.**—The mobilised testis is placed without traction on the inner aspect of the thigh, opposite the lower part of the reasonably stretched scrotum. Here an incision  $1\frac{1}{2}$  inches long is made obliquely from above, downwards and inwards on the inner surface of the thigh (fig. 29: 1, 2). The depth of the incision extends to the fascia lata, care being taken to avoid injuring the internal saphenous vein.

From the inguinal wound two fingers are inserted into the scrotum and an incision is made in the lower and outer scrotal wall through all its layers. This incision is also  $1\frac{1}{2}$  inches long. The posterior edge of the scrotal wound is sutured to the posterior edge of the thigh wound. As these sutures are later inaccessible No. 0 chromic catgut is used.

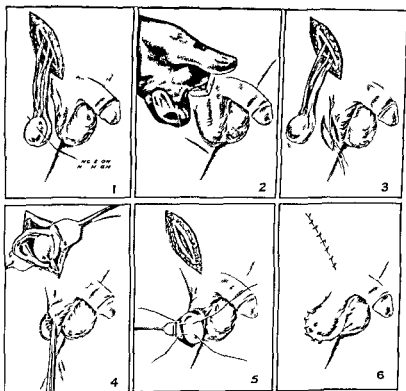


FIG. 29.—Orchiopexy by implantation into the thigh (The Keetley-Torek operation.)

Interrupted sutures are placed so as to evert the skin edges (fig. 29 3). The testicle is brought down through the hole in the scrotum (fig. 29 4). The tunica albuginea is stitched with two or three interrupted sutures of No. 1 chromic catgut to the fascia lata (fig. 29 5). The anterior edge of the scrotal wound is sutured to the corresponding



edge of the thigh wound with interrupted sutures of fine silk-worm gut, care being taken to get exact skin-edge approximation (fig. 29: 6). Between the groin and the cruro-scrotal tunnel is placed a substantial piece of gauze anointed with sterile vaseline or aseptic dusting powder.

As soon as the wound has healed, the patient can be dismissed for three or four months, the only instructions being that he must keep the groin clean (fig. 30). The



FIG. 30.—The testis in the thigh causes no inconvenience.



FIG. 31.—After 3 or 4 months the scrotum is detached from the thigh. (H. W. Meyer.)

patients are remarkably free from any inconvenience occasioned by the cruro-scrotal tunnel. After three or four months the scrotum is detached from the thigh, and the testis lies at the bottom of the scrotum.

**Results.**—The published results of this operation are extraordinarily good, many series showing round about 100 per cent. successes. It must be pointed out that in order to implant the testis into the thigh, the cord must always be of an adequate length. When it is impossible to obtain the necessary length, the method must be abandoned in favour of another technique, for instance, trans-septal implantation.

For this reason the results of implantation into the thigh have an advantage.

**Mistakes and Misfortunes.**—The tendency to make the tunnel too low must be avoided (fig 32). This also puts



FIG 32—The scrotal tunnel has been made too low (C G Burdick and B L Coley)

undue tension on the scrotum and the stitches tend to cut out admitting infection. Infection from this cause and from (possibly) inadequate skin preparation are the chief disadvantages of the operation. If infection follows the testis often sloughs. This occurs in about 4 or 5 per cent of cases in some of the published series.

**Modifications of the Operation.**—The principal modifications of the operation are various departures in suturing the testis to the thigh. Instead of stitching the tunica albuginea to the fascia lata directly some operators fasten the gubernaculum to the fascia while others notably Wangenstein use the cruro scrotal tunnel only to transmit sutures from the testis which reposes in the scrotum to the fascia lata.

#### A TEMPORARY INTERNAL WIRE SPLINT

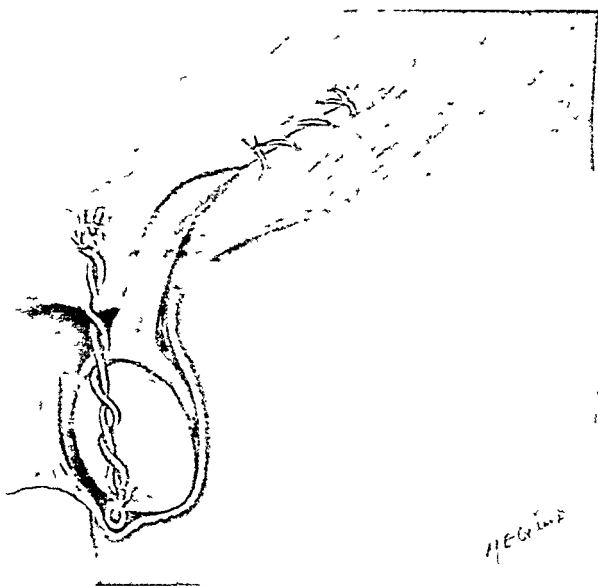
**Evolution of the Operation.**—F N G Starr of Toronto described his operation of a temporary silver wire splint fixed to the periosteum of the pubis on the one hand and to the testis on the other in 1908. Starr brings the ends of the wire out through a nick in the bottom of the scrotum. The operation was demonstrated to me in 1921 by Professor Kelly of Liverpool. I have practised it since then slightly modifying the method to make it a closed operation. The method can be practised with towels draping the entire area through out the operation.

**Technique.**—A piece of stout silver wire is plaited (fig 33). It is of such a length that it will extend from the front of the pubis to the bottom of the scrotum pushing the scrotum

slightly before it. I have used the same splint over and over again, but the materials to make a fresh one should be at hand. for the length required varies somewhat with the individual. The tunica albuginea about the middle of the testis is attached to the loop by a No. 0 *ten-day* chromic catgut stitch. The testis is then placed in the scrotum, and the other end of the splint is fixed by two No. 1 *ten-day* chromic catgut stitches. The first stitch goes around the splint; the second is insinuated in the space between the extremities of the wire before it is tied, thus preventing the wire riding up (fig. 34). After these stitches have been placed, but before they are tied, the assistant steadies and pushes downwards the splint, which is held in a hæmostat.



FIG. 33.

FIG. 34.—Diagram showing the internal wire splint *in situ*.

After the repair of the inguinal canal, the skin wound is closed and an anchor dressing of gauze applied. No other dressing is used. The patient is returned to bed, with an

inverted theatre basin protecting the scrotum from possible jabs during transit. When he is in bed the basin is removed and a bed cage is placed over the trunk.

On the twelfth day the wire is removed thus. A drop or two of local anæsthetic is injected into the skin over the prominence caused by the wire loop (fig 34). A tiny incision is made on to the wire which protrudes at once. The protruding portion is seized with a hæmostat and with a sharp pull out comes the splint—the ten day catgut has dis-



FIG 35 —X ray showing the wire splint *in situ*

integrated. There is no pain or inconvenience and as soon as the splint has been removed the patient can get up.

#### ADVANTAGES

- 1 The operation can be conducted without fear of infection from the skin. It is a closed operation from start to finish. I have never had a case complicated by infection.

- 2 There is no second operation.

- 3 The results in an unselected series of cases rival those of the Keetley Torek operation (fig 37).

## ORCHIOPEXY BY EASY STAGES

This opens up a new arena for a finally successful issue. Undoubtedly the cord lengthens with gradual traction (see p. 20). Several cases are on record where the testis has



FIG. 36.

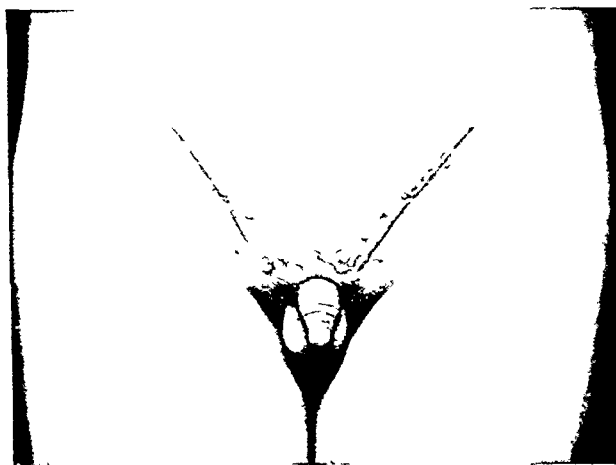


FIG. 37.—Intra-abdominal testes brought down at the age of 15. A temporary internal wire splint was used.

been brought down so far, say to the external abdominal ring, and three to six months later, at a second operation,

complete orchiopexy has been possible. In at least one case a three stage operation eventually proved absolutely successful. With this possibility in view no case of orchiopexy need be abandoned prematurely and the need for orchio-cœliopexy or orchidectomy sinks into insignificance.

A point of cardinal importance is to postpone suturing the conjoint tendon to Poupart's ligament until the final operation has been performed. If the inguinal region is reconstituted the difficulties in freeing the cord at a subsequent operation will be familiar to all who have operated upon recurrent inguinal herniæ.

### ORCHIOCÆLIOPEXY

This method is hardly ever called for. Occasionally it may be justified if it is essential to subserve the internal secretion of a testis when for some reason all hope of orchiopexy has to be abandoned. In older children it is easy to make an adequate extraperitoneal nook in the iliac fossa for the reception of the gland. In young children when the testis and its cord are contained virtually in a patent processus vaginalis Pannett recommends that the sac be split up to the internal ring and excess of peritoneum having been removed the free edges of the peritoneum are united behind the cord as in Jaboulay's operation for hydrocele. The testicle can then be placed in the abdomen and the inguinal canal repaired.

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## CHAPTER VII

### SURGICAL ANATOMY AND PHYSIOLOGY OF THE TESTES

THE body of the testis is invested by three tunics

The *Tunica Vaginalis* covers the greater part of the testis and epididymis. It connects the latter with the testis by a distinct fold. Its parietal layer is more extensive than its visceral layer and it is continued up the cord for a varying distance.

The *Tunica Albuginea* is the thick white covering. Above and posteriorly it sends a prolongation to the gland—the *mediastinum testis*—thus cutting off a sector more or less

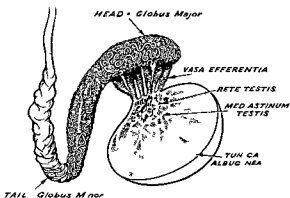


FIG 38 —Showing the tunica albuginea and its ramifications

completely (fig 38). This sector is broader above than below. From the mediastinum testis are given off transversely radiating septa which divide the body into compartments or lobules. The tunica albuginea supports the vessels and ducts in their passage to and from the gland.



The Tunica Vasculosa is the vascular layer. It accompanies the various septa of the foregoing and lies immediately beneath the tunica albuginea.

### THE PARENCHYMA OF THE TESTIS

Lobules form the parenchyma of the testis—there are about three hundred of these lobules and each contains one or more *convoluted tubules* (fig. 39): when unravelled and

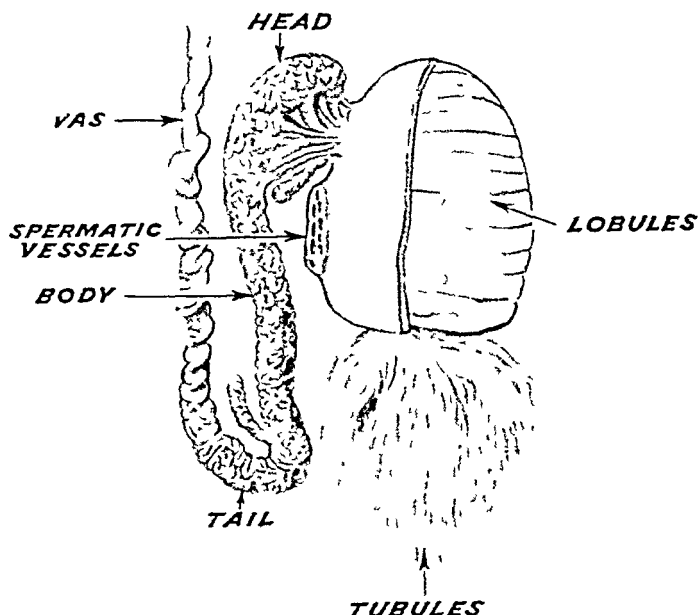


FIG. 39.—The anatomy of the component parts of the testicle. (After Testut.)

straightened each tubule measures about 2 feet in length. By teasing under water the tubules can be unravelled separately, when they will be seen to commence in a blind extremity or by an anastomotic loop with a fellow. It has been estimated that a well-developed testis contains 840 tubules, which are the sperm-forming element. As the tubules approach the mediastinum testis they become less convoluted and they unite together forming twenty or thirty larger ducts. Because of the comparatively straight course these ducts pursue they are named the *vasa recta*. The *vasa recta* pierce

the mediastinum and forthwith anastomose freely with one another, forming the *rete testis*, which has exceptionally thin walls. The rete testis terminates in fifteen to twenty ducts—the *vasa efferentia*—which perforate the tunica albuginea to carry semen to the head of the epididymis.

### HISTOLOGY OF THE SEMINIFEROUS TUBULES

A cross section of a seminiferous tubule shows it to be constituted as follows. There is a basement membrane upon which is found

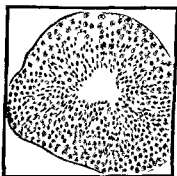


FIG. 40.—Transverse section of a seminiferous tubule  $\times 150$  (Hart ridge and Haynes)

seminiferous tubules is a network of connective tissue which contains the interstitial cells of Leydig. These cells are believed to secrete the hormone which controls the secondary sexual characteristics of the male. It has been estimated for the rabbit and guinea pig at any rate that one sixteenth of one normal testis is sufficient to permit the development of secondary sexual characteristics.

a number of layers of cells. The basal layer contains cells of two varieties: the *spermatogonia*, which are the more numerous, and the *sustentacular cells*, or columns of Sertoli (fig. 40). Spermatogonia are rather large cells and their nuclei are mostly in the resting stage. Proceeding towards the lumen of the tube cells in various stages of development towards spermatozoa can be recognised. Full fledged spermatozoa can be seen in the lumen, their tails pointing centralwards. It should be noted that spermatozoa are motionless until they have come in contact with prostatic fluid. Between the

### THE EPIDIDYMIS

The enlarged upper extremity of the epididymis is called the *head* (*globus major*); the lower and smaller end is the *tail* (*globus minor*), and the intervening narrow portion represents the *body*. The head and tail are connected to the body of the testis by fibrous tissue and by a reflection of the tunica vaginalis. The head of the epididymis is further connected by the *vasa efferentia*. The bodies of the testis and the epididymis are but loosely connected, and here is situated the *digital fossa*.

The epididymis is composed of the convolutions of the

secretory duct. Commencing in a blind extremity in the head of the epididymis, it consists of a single tube having a diameter of about one-sixteenth of an inch. In the body of the epididymis the diameter of the secretory duct diminishes a little, whereas in the tail it enlarges again. The tube of the epididymis is folded over and over again on itself, the convolutions being held together by loose connective tissue. When the convolutions are undone, the tube of the epididymis measures from 12 to 20 feet in length.

**The Pampiniform Plexus.**—The spermatic veins issue from the body of the testis at its posterior border (see fig. 39). In the cord they arborise to form the pampiniform plexus which constitutes the greater mass of the cord. Near the external abdominal ring the pampiniform plexus can be segregated into two groups—anterior and posterior (fig. 41). In the inguinal canal these coalesce to form two veins which accompany the spermatic artery. Eventually, the two veins unite to form a single trunk. The spermatic veins receive tributaries from the ureteric veins and on the left side from the sigmoid veins.

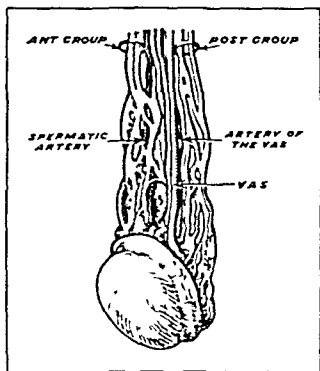


FIG. 41.—The pampiniform plexus near the external abdominal ring. It can be separated into two groups.

**The Spermatic Artery** arises

from the aorta below the renal artery. It crosses obliquely over the lower part of the ureter and the lower part of the external iliac artery to reach the internal abdominal ring, through which it passes. The spermatic artery gives one or two branches to the cremaster muscle (Gray).

**The Artery to the Vas**, a branch of the superior vesical, also gives branches to the epididymis.

**The Cremasteric Artery** is a branch of the deep epigastric, and it supplies the coverings of the cord.

**Nerves.**—The coverings of the testes are richly supplied with nerves. There are the ilio-inguinal and the genito

crural branches of the lumbar plexus the two superficial perineal branches of the internal pudic and the long pudendal branch of the small sciatic nerve. All these go to the coverings of the testes. The testis itself is supplied

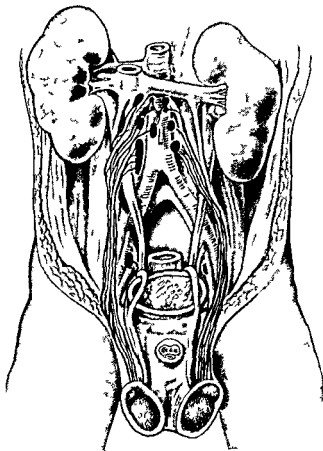


FIG. 42.—Lymphatics of the testes (After Roux)

apparently only by the sympathetic plexus which accompanies the spermatic artery.

#### LYMPHATICS

The lymphatic drainage of the testis is very important for it is by this path that neoplasms of the testis disseminate

**Lymphatic Vessels.**—The collecting vessels are four to eight in number. They pass out of the mediastinum testis and ascend with the veins of the cord to the subperitoneal tissues. Over the psoas muscle they spray themselves in graceful curves to reach the lumbar glands (fig. 42).

**Lymphatic Glands. Principal Series.**—*On the left side* the glands lie in close relationship to the left side of the aorta. The main group is situated near the origin of the inferior mesenteric artery. The highest gland is just beneath the left renal artery, and the lowest is in relationship to the left common iliac.

*On the right side* the glands lie in the groove between the aorta and the vena cava. There is often a gland on the vena cava itself at the level of the bifurcation of the aorta. As on the left side, a gland is likely to be present as high as the origin of the right renal artery, and there is a fairly constant gland in close relationship to the ureter as low as the brim of the true pelvis.

**Lymphatic Glands. Second Series.**—The chief secondary glands are a chain on the outer side of the common iliac artery. Glands of the first series of one side are secondary glands so far as the contralateral side is concerned.

From this description it will be appreciated that the glands on the left side are more accessible than those on the right.

### ANATOMICAL VARIATIONS

**Inversion.**—The body of the testis usually lies in front. Several degrees of varieties of inversion have been described (fig. 43). Usually the anomaly is unilateral.

*Superior Inversion.*—The epididymis lies above the body.

*Anterior inversion* is said to be present in one in every twenty males, but this estimate is probably too high. The epididymis lies in front, and the body of the testis and the tunica vaginalis behind. When the testis is diseased this anomaly causes much confusion in diagnosis.

*Lateral inversion and loop inversion* are uncommon and unimportant.

**Polyorchism.**—In days gone by supernumerary testes

were supposed to be fairly common. Doubtless cysts of the epididymis and other more or less globular swellings in the neighbourhood were mistaken for extra testes. Often their possessors waxed proud and tales of their prowess were noised abroad. Polyorchism is in reality of great rarity: there are but thirteen authentic cases on record.

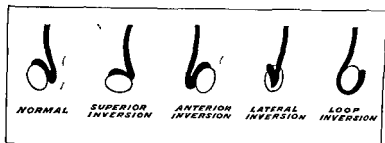


FIG. 43.—Varieties of testicular inversion. (After W. F. Campbell.)

Usually the testes have a single vas and an epididymis stretched out to serve them both. The supernumerary organ is nearly always small. Curiously, ten out of the thirteen recorded cases have been left-sided.

**Anorchism**—Anorchism is as rare as polyorchism. There is only one method of being quite certain that a testis is not present, and that is by a careful post mortem examination. It is well to bear in mind that there is no authentic case of a testis having been found in the place of its origin beneath the kidney; this upsets a popular belief. Surgical exploration of the inguinal region is a tolerably certain method of deciding whether or no the patient possesses a testis on that side.

### EUNUCHS

Bulls that are castrated lose their fiery spirit, but are not deprived of their fitness for labour; dogs likewise cease to desert their masters, but are not less fitted for watching or the chase; and men also, by being deprived of desire, become more gentle, but are not worse horsemen nor less able to throw the javelin.—*Xenophon*.

Through the ages there have been eunuchs. Many were conscripted from the sons of the vanquished. Unless deprived of all their male attributes, their commercial value

was low. Even down to our own times, demasculation was conducted brutally and carried a mortality of 80 per cent. Latter-day eunuchs were mostly little Nubian boys, bought, mutilated, and sold by priests of the Coptic monasteries. The penis and testes were excised without any form of anæsthesia. Bleeding was staunched by the application of boiling oil. The boy was then placed standing in a pit full of sand, and in the few survivors the wound healed. The majority of the victims suffered from post-operative urethral stricture with its inevitable train of chronic ill-health.

With the winds of fortune so set against him, it is almost inconceivable that a eunuch could overcome his psychological and physical disadvantages, gain esteem, and attain a position of respect. Nevertheless, many eunuchs have lived to an advanced age, and some have occupied positions of great importance. To quote a few only : Narses was a distinguished general, Hermias became the governor of a province in Asia Minor, and Pothinus was the Egyptian Minister of Finance in Cæsar's reign.

Eunuchs were in power in the Roman Empire during its decline, and they have been held responsible, notably by Gibbon, for the evils which permeated the Byzantine court. Possibly this view is incorrect, and the eunuchs' rise to power was due to the fact that they were less engrossed in the debauchery and licentiousness which enfeebled their compatriots.

**Singing Eunuchs.**—So much were their vocal accomplishments extolled by the mediæval Roman Church—" *La voix des castrates imite celle cherubins au ciel* "—that upwards of two thousand boys were castrated annually for service in the choirs.

The popular belief that castrates are sexually unmoved, if not impotent, is ridiculous ; in fact, several singing eunuchs of the famous St. Peter's choir were ordered to be deported from Italy because of their illicit popularity among the Roman matrons.

T. E. Hammond studied the lives of seven men castrated during manhood for bilateral testicular tuberculosis. Soon

after castration the majority experienced increased sexual desire, due, it is thought, to irritation of the spermatic nerves. Later, desire decreased, but the majority of these patients were not impotent. Most of them put on weight, and shaving had to be carried out less often. There was no change in the voice, no waning of mental activity, and no impairment of physical strength attributable to the removal of the testes.

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## CHAPTER VIII

### CLINICAL EXAMINATION OF THE TESTICLE

SEPARATED as it is from the examining fingers by little more than a covering of extremely loose integument, the testicle is unrivalled among organs for accessibility. This, one might reasonably imagine, should make the diagnosis of testicular swellings a simple matter. Be that as it may, it is a truism that if a clinician feels that he is becoming puffed up with pride, let him dwell upon a comparison of the operative findings of a series of testicular swellings and his pre-operative diagnoses thereof!

#### ROUTINE EXAMINATION

The patient should (at least) let down his trousers completely and roll up his shirt to the nipple line. He should stand before the seated clinician.

**The Skin of the Scrotum.**—First of all the skin of the scrotum is investigated. It is noted especially if it is anchored at any point to the underlying testis. If it is fixed anteriorly, it is slight contributory evidence of gumma; if posteriorly, of tuberculosis; while an advanced new-growth may invade any portion of the overlying skin, the antero-lateral aspect being the site of election. A. C. Morson has pointed out that in early testicular tuberculosis there is often a loss of cutaneous elasticity, as shown by smoothing out of the rugæ, and wasting of the cellular tissues immediately beneath the dermis.

**Palpation.**—In order to carry out a thorough examination of the testis, it is most necessary to examine its constituent parts in some definite order (fig. 44).

(1) The body of the testis is palpated and compared with the unaffected side. Among other things, the mobility of the organ is noted. Normally the testis can be moved freely

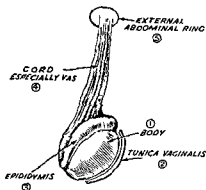


FIG 44—Order in which the constituent parts of the testicle are palpated

terior surface of the testis, but in these rare instances the whole testis is anteverted, and the epididymis lies in front (p 50)

(3) The epididymis is palpated first its head then its body, then its tail That the epididymis or some part of it

within its coverings particularly in an upward and downward direction This movement is often restricted in tuberculosis

(2) Whilst palpating the body of the testis, the relationship of the tunica vaginalis to the anterior surface of the organ is borne in mind In a small percentage of cases the tunica vaginalis lies on the pos

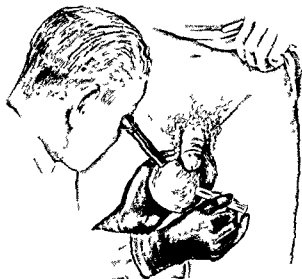


FIG 45—The transillumination test in use

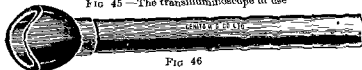


FIG 46

is enlarged is soon apparent. A craggy epididymis is almost pathognomonic of tuberculosis.

(4) The vasa are palpated in the following manner. Using both hands, both cords are palpated simultaneously, and as these whipcord-like structures (the vasa) pass through the fingers their relative size is estimated.

**Test for Translucency.**—Anyone who is in close touch with clinical surgery will have seen scores of cases where the diagnosis has been vitiated, occasionally with disastrous results, by not carrying out the test for translucency or by carrying it out inefficiently. In the case of an intra-scrotal swelling, the first essential is to make it tense by grasping the neck of the scrotum between the fingers and thumb. A pocket-torch is applied to the distal side of the swelling (fig. 45), and most hydroceles can be diagnosed at once irrefutably. There are cases in which the sign is doubtful, especially in sunlight. My pocket transillumino-scope (fig. 46) makes errors connected with this basic sign improbable. The fallacies of efficient transillumination in the diagnosis of hydrocele are few. Obviously, if the walls are thick or calcareous the sign will be negative. A hernia of a child, if it contains gut distended with gas, is likely to be translucent.

Sometimes a secondary hydrocele confuses the issue. If doubt exists as to the condition of the underlying parts, it is advisable to aspirate the fluid there and then, and to palpate the unmasked organ.

A secondary hydrocele is present:

- (a) Almost always in acute and subacute epididymo-orchitis.
- (b) In nearly all early cases of syphilis of the testis.
- (c) In 30 per cent. of cases of testicular tuberculosis.
- (d) Rarely in neoplasm.

**Testicular Sensation.**—The normal testis is squeezed gently between the finger and thumb (fig. 47). The patient experiences a peculiar sickening pain. Testicular sensation is lost early in syphilitic affections of the testis, but late in neoplasms. The test is a reliable one.



FIG 47 —Testing testicular sensation



FIG 48 — Weighing the testis

**Weighing the Testis.**—The affected organ is balanced on the palm of the hand and its weight estimated (fig. 48). A testis which is relatively heavy is in favour of neoplasm

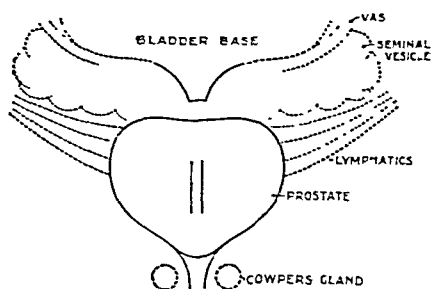


FIG. 49.—The parts in *black* are felt normally, those in *red* only when they are diseased. (After Sir John Thomson Walker.)

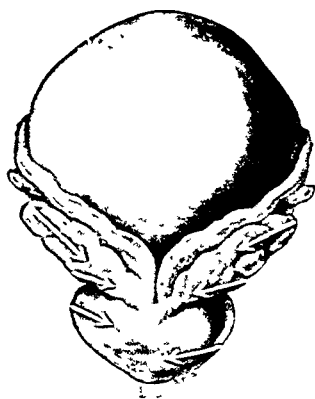


FIG. 50.—Directions in which to massage the prostate and vesicles.

or old clotted hæmatocele; one which is relatively light is in favour of gumma.

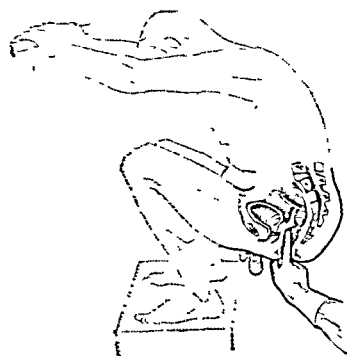


FIG. 51.—Luys' method of examining the seminal vesicles in a difficult case.

**Examination of the Regional Lymph Glands.**—In selected cases it is necessary to endeavour to palpate the regional lymph glands. Three sets of lymphatic vessels pass up the spermatic cord in order of importance:

(a) Those following the spermatic artery, which pass to the para-aortic glands just below the origin of the renal arteries.

(b) Those following the artery to the vas, which pass to the internal iliac glands.

(c) Those following the cremasteric artery, which pass to the inguinal glands.

If the testis is the seat of an advanced neoplasm, secondary

deposits are to be expected in the para aortic glands above the level of the umbilicus

**Rectal Examination** —With the sole exception of a simple hydrocele a rectal examination should never be omitted as part and parcel of the routine examination of a case of testicular disease

The parts to be examined digitally are diagrammatically represented in fig 49 Particular attention must be paid to the vesicles Sliding the finger upwards along the median prostatic furrow a little to the side of the top of the prostate on each side lie the seminal vesicles The normal vesicle cannot be felt unless distended with semen If the examiner is endowed with a long finger these structures can be palpated readily When the patient is obese or the prostate is enlarged palpation of the vesicles becomes difficult In such circumstances G Luys recommends that the examination should be made with the patient in the position indicated in fig 51

In relevant cases the prostate is massaged and the vesicles emptied (fig 50) the patient being in the knee elbow position The penile urethra is milked down The urinary meatus is then examined for a bead which is collected on a slide for further scrutiny

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## CHAPTER IX

### TESTICULAR THERAPEUTICS IN GENERAL

#### THE PREPARATION OF THE SKIN

THE preparation of the skin for operations upon the testicle should be thorough. Iodine and alcohol are highly unsuitable agents for skin preparation in this region; so often they cause irritation of the scrotum, and both give rise to much smarting pain when first applied. Picric acid is free from these objections.

**Skin Incisions.**—While I usually approach the testicle through an inguinal incision because this permits early and high infiltration of the spermatic cord with local anæsthetic, the objections sometimes raised to an incision through the scrotum have been, in my opinion, unduly magnified. If prepared with picric acid, the scrotum can be rendered surgically clean, and scrotal incisions appear to heal well by first intention.

#### ANÆSTHESIA FOR OPERATIONS ON THE TESTICLE

There are few operations upon the testicle which cannot be performed absolutely satisfactorily under local anæsthesia. The skin overlying the inguinal canal is infiltrated with 1 per cent. novocaine (fig. 52). The cord is then identified as it emerges from the external abdominal ring. Very gently it is mobilised, and then infiltrated thoroughly with the anæsthetic solution delivered through a hypodermic needle (fig. 53). The cord distal to the infiltration and the testicle are within one minute absolutely anæsthetised. After this infiltration the only discomfort the patient will feel—and this discomfort is slight—is the manipulation of the scrotum through the towels in order to deliver the testicle through the wound. If the incision is of adequate

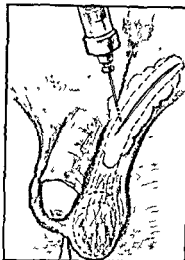


FIG 52 —The skin over the proposed line of the incision is infiltrated

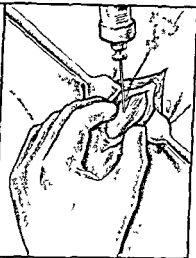


FIG 53 —The cord is then identified and injected thoroughly. The testicle is then perfectly anaesthetised

size, delivery of the testicle is not difficult unless it is adherent to the scrotum. Once the testicle has been delivered, the remainder of any operative procedure on the testicle is painless.

#### POST-OPERATIVE SCROTAL HÆMATOMA

The great bugbear to operations in this region is post-operative scrotal hæmatoma. This can be obviated to a large degree, by meticulous attention to hæmostasis. When ever possible, the diathermy knife is preferable to the ordinary scalpel. The application of a Bellevue bandage (see p. 62) greatly minimises this complication.

When a post-operative scrotal hæmatoma has formed, only too often no active course is pursued, and, as a consequence, convalescence is delayed for weeks. The long wait necessary for absorption to take place and risks of infection of massive blood clot can be obviated by evacuating promptly the blood and blood clot in the following manner. After suitably infiltrating the overlying skin with local anæsthetic towards



its most dependent part, the over-full scrotum is punctured with a trocar and cannula. Through the cannula the blood-clot is broken up and washed out with normal saline introduced by a syringe attached to a lumbar-puncture needle. Afterwards the scrotum is elevated and compressed by a Bellevue bandage. Since adopting this simple measure I have been gratified with the results, and particularly with the hastening of convalescence.

### BANDAGES AND SPLINTS FOR THE TESTICLES

**The "Jock Strap."**—While the ordinary suspensory bandage obtained at the chemist's is but little more than a

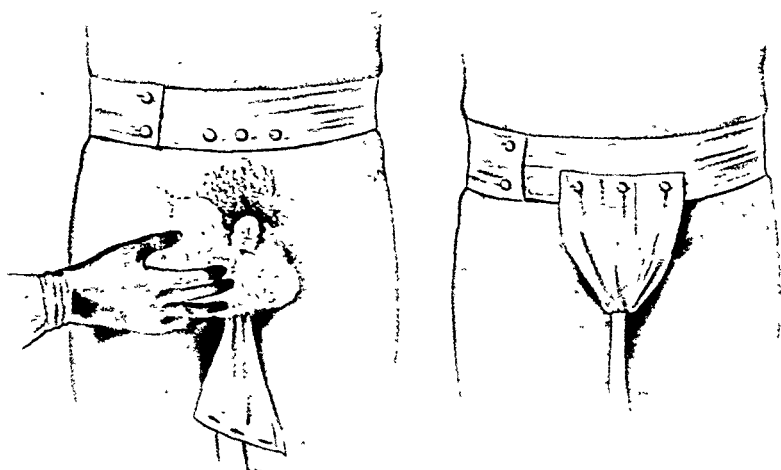


FIG. 54.—The jock strap—showing how a nest of cotton-wool elevates the contents of the scrotum. (After P. S. Pelouze.)

placebo, the jock strap is efficient. It is particularly useful in the ambulatory treatment of mild epididymo-orchitis without constitutional symptoms. The jock strap should be a size smaller than would be worn normally so as to extend support and mild pressure. Further to gain this end the scrotal contents are pushed forwards by a nest of cotton-wool (fig. 54).

**A Bridge of Adhesive Plaster.**—A very useful splint for supporting inflamed testicles or for use after operations

upon the testicle is made by applying broad adhesive plaster (not elastoplast) to the thighs in the manner shown in fig 55. With the legs in apposition and the scrotum elevated, the strip of adhesive plaster is applied tightly across the thighs well up towards the perineum. A little

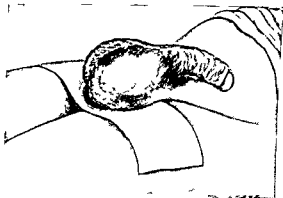


FIG 55 —A splint for the testicles

pad of cotton wool, upon which is sprinkled dusting powder, makes a good nest upon which the testicles can lie. A bed cage is used to prevent pressure from the bedclothes.

**The Bellevue Scrotal Bandage.**—Far the best scrotal bandage is that used at the Bellevue Hospital. It is extremely useful to apply this bandage after any operation where a post operative scrotal hæmatoma is feared, for it definitely minimises this complication. The Bellevue bandage is also a great boon in the treatment of acute epididymo orchitis, especially when it is due to the gonococcus.

Instructions for making the bandage are detailed in fig 56. Either adhesive plaster or elastoplast can be used. The top of the bandage is divided into two equal parts by tearing it down 11 inches. An inverted V is cut in the other end of the plaster 16 inches deep, to make two perineal strips. A piece of gauze 4 inches wide and a roller bandage  $2\frac{1}{2}$  inches by 1 inch are placed as shown; the latter is best stitched to the adhesive. The bandage is

applied in the following manner. The scrotum is elevated and the gauze pad is applied to the perineum, the roller bandage being tucked behind the root of the scrotum.

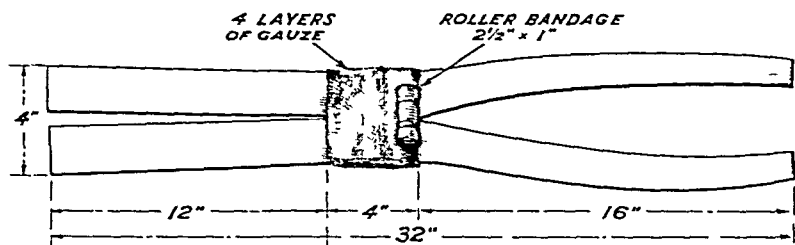


FIG. 56.—The construction of the Bellevue bandage.

The other hand places the broad strips over the inguinal regions, and they are held until they stick firmly. The perineal strips are then brought round the thighs in the gluteal folds over the anterior superior spine. To make

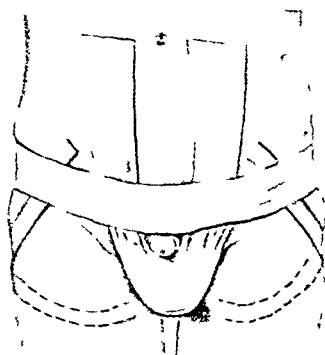


FIG. 57.—The Bellevue bandage applied.

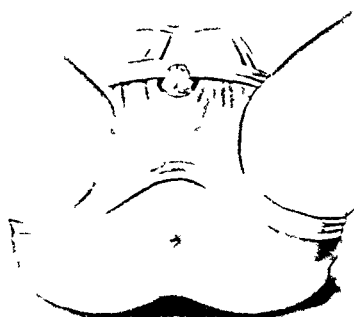


FIG. 58.—Same showing perineal strips.

the suspensory bandage stick to the skin better, another piece of adhesive plaster is made to adhere over the hypogastrium from one great trochanter to the other (figs. 57 and 58).

### ON ORCHIDECTOMY

The modern tendency is to save the testicle. Orchidectomy is performed far less often than previously. Better

Largo hydroceles tend to compress the testis and, to a certain extent, cause it to atrophy

### VARIETIES OF HYDROCELES

Anatomical varieties of hydrocele are largely a matter of academic interest. They are depicted in fig 59. A few of these require some detailed consideration.

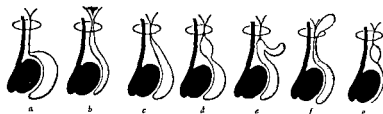


FIG. 59.—(a) vaginal hydrocele, (b) congenital hydrocele, (c) infantile hydrocele, (d) hourglass hydrocele, (e) bilocular hydrocele, (f) abdomino-scrotal hydrocele, (g) encysted hydrocele of the cord.

**Congenital Hydrocele**—The processus vaginalis communicates with the peritoneal cavity. Usually the communicating orifice is too small for the development of a hernia. When the scrotum is elevated the fluid disappears within the abdominal cavity, usually slowly, but it returns when the erect posture is resumed. Especially in bilateral cases ascites or serous tuberculous peritonitis should be suspected.

**Infantile Hydrocele** does not necessarily appear in infants. The tunica vaginalis and the processus vaginalis are distended right up to the internal abdominal ring, but the sac has no connection with the general peritoneal cavity.

**Abdomino-scrotal Hydrocele**—A number of cases have been described where the hydrocele sac has extended into the abdominal cavity in front of the peritoneum, the first case being reported by Richards in 1908 in an Egyptian. Sometimes the abdominal extension is immense (fig 60).

**Encysted Hydrocele of the Cord**—This fairly common condition causes some confusion in diagnosis. There is a smooth oval swelling associated with the spermatic cord. When such a swelling is situated at the external abdominal ring it is very liable to be mistaken for an irreducible inguinal hernia. If with gentle traction upon the testis the swelling moves downwards, the diagnosis of hydrocele of the cord is confirmed.

When a "hydrocele" is referred to, it is the common idiopathic vaginal hydrocele which is assumed, and it is this variety which we will consider more fully.

### IDIOPATHIC VAGINAL HYDROCELE

The tunica vaginalis is the smallest serous cavity in the body, histologically it resembles the pleura, pericardium

and peritoneum. Why an idiopathic hydrocele develops is a matter for conjecture. Very suggestive is the theory that it is due to a transient or bygone epididymo-orchitis. If potassium iodide is injected into a normal tunica vaginalis, the drug can be recognised in the urine after the lapse of an hour (C. B. Huggins). Absorption from the tunica vaginalis is slower than from other serous cavities; it is slower still from a hydrocele sac, especially one of long-standing. This suggests the reason why hydrocele fluid accumulates. It is this extremely slow, practically negligible, absorption which makes injection treatment of a hydrocele possible.

**Clinical Features.**—I do not propose to reiterate the clinical features of an ordinary hydrocele. Nevertheless, the following case shows that still it is necessary to emphasise that before making the diagnosis, and, what is even more important, before tapping, one must be satisfied that the swelling is translucent and that one can “get above the swelling.”

I was called to an outlying district one Sunday morning, and found a stout, terrified man lying in bed. There was much blood upon the sheets and blood was flowing from a considerable puncture wound in the scrotum. On a table beside the bed there was a large-calibre trocar which had been used to tap the “hydrocele.” Subsequent operation showed that the instrument had been thrust into the



FIG. 60.—Radiograph after injecting a hydrocele with a properitoneal extension with sodium iodide. Showing the enormous intra-abdominal loculus. (After J. N. Holmes.)

mesentery of a loop of small intestine contained in a strangulated inguinal hernia

One other point before leaving this subject. After a hydrocele sac has been tapped, the opportunity for palpating the testis thoroughly should be taken. If some abnormality is found in the contour of the testis or the epididymis, it is highly probable that the hydrocele is a secondary hydrocele. Early malignant disease, which would otherwise have been missed, has been diagnosed by not failing to make a routine examination after tapping.

### THE INJECTION TREATMENT OF HYDROCELE

Modern sclerosing agents have made the injection treatment of hydrocele tolerably satisfactory. A tremendous advantage of the treatment is that it is ambulatory. A number of sclerosing agents have been used.

1. Five c c of a 5 per cent solution of sodium morrhuate
2. Two to 5 c c of quinine urethane
3. Three to 5 c c of quinine urea hydrochloride
4. Ten c c of a solution containing 2 grains of quinine bihydrochloride and 1 grain of salicylic acid
5. Two to 4 c c of Moreston's fluid, which is a mixture of equal parts of carbolic acid, glycerol, and alcohol

The solutions which I have tried are 1 and 2, and of the two the quinine urethane has been the more satisfactory.

L. C. Dawson recorded a case of a patient of 45 who, one minute after injection of sodium morrhuate into the hydrocele sac collapsed and the pulse became almost imperceptible. Morphine was required for forty eight hours to relieve the pain.

Quinine urethane has not given rise to pain in any of my cases, and there has been no untoward sign. The majority of the patients have been in active employment during the treatment. L. Blavier, using quinine urea hydrochloride, finds that one injection is usually effective. Although the fluid in the sac reaccumulates, and at the end of the week the hydrocele appears to be as big as before, within three

or four weeks the exudate is generally absorbed. Most observers recommend two or three injections at intervals of a week, and this has been my practice.

**Technique of the Injection.**—The scrotum is sterilised with picric acid. A small wheal is raised on the skin with 1 per cent. novocaine introduced with a hypodermic syringe. Using a lumbar puncture

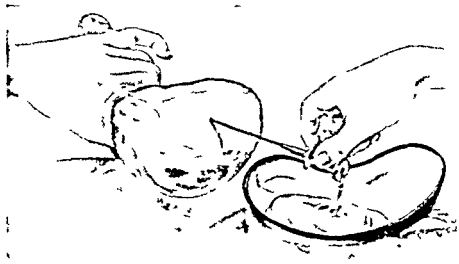


FIG. 61.—A lumbar puncture needle is used to tap the hydrocele.



FIG. 62.—Large bilateral hydroceles of many years' duration. With tapping they used to fill up in a few weeks. Nine months after three injections to each hydrocele there was no reaccumulation of the fluid.

dure needle, the fluid is allowed to escape (fig. 61), or is drawn off with an aspirating syringe. The interior of the sac is then washed out by injecting and withdrawing some normal saline or sterile water. This ensures that the interior of the sac is free from albuminous matter, which might interfere with the action of the sclerosing agent. The appropriate dose of the selected solution is then injected into the sac and is massaged into every corner of it. In thin-walled recent hydroceles, because of the potential absorptive powers of their walls (see above), a minimal dose should be used, at any rate on the first occasion. The puncture is sealed with collodion, and the patient is instructed

to wear a suspensory bandage until his next attendance. He should be told that the fluid will probably reaccumulate quickly and this should not be a cause of disappointment.

I regard hydroceles in children unsuited to injection treatment. In all probability the sac would not have lost its absorptive properties. If simple tapping fails—it is sometimes curative in these cases—operation should be carried out.

#### OPERATIVE TREATMENT OF HYDROCELE

The operative treatment of a hydrocele is extremely satisfactory. It can be performed painlessly under local

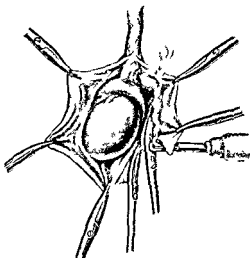


FIG. 63 —Excision of a hydrocele sac with an electric cauterium

anæsthesia and its only disadvantage is that the patient is invalided for ten days or a fortnight. After injecting 1 per cent. novocaine along the line of an inguinal incision the cord is identified and injected thoroughly with the same solution delivered through a hypodermic needle. The only discomfort the patient will feel is the pressure upon the scrotum necessary to deliver the hydrocele through the



incision. This can be obviated to some extent by tapping before the operation is commenced—a step which is definitely advised when the hydrocele is a large one. Once the testicle is delivered on to the surface, there will be no further discomfort. With scissors the sac is opened along its length. Clipping, then cutting, preferably with a diathermy knife or, failing that, with another form of cautery, the hydrocele sac is excised as near the testicle as possible (fig. 63). In addition to the cautery excision, ligatures are placed around each moiety grasped in the hæmostats. This dual precaution ensures the prevention of post-operative scrotal hæmatoma, the chief bugbear of hydrocele operations. The above operative measure meets every requirement.

Some years ago I performed a series of cases by Jaboulay's operation, which is eversion of the tunica with posterior anchoring sutures. The disadvantages of eversion are :

(a) If the tunica is thick a lump representing the turned-back tunica persists behind the testis.

(b) Recurrence. Even after Jaboulay's operation has been carefully performed, fluid accumulates occasionally in the everted sac.

Jaboulay's operation is successful particularly in thin-walled hydrocles, which should be to-day treated by injection.

### COMPLICATIONS OF HYDROCELE

All the complications of hydrocele are comparatively rare.

1. **Hernia of a Hydrocele Sac** (fig. 64) sometimes occurs in old-standing cases. Tension of fluid within the tunica causes herniation of a portion of the sac through some of the coverings of the testis.

2. **Rupture** is usually traumatic, but possibly spontaneous. The patient complains of sudden pain followed by scrotal œdema. With rest, the fluid is absorbed, but usually the hydrocele recurs (Nash).

3. **Calcification** of the sac wall is not very uncommon in long-standing cases.



FIG. 64 —Herniation of a hydrocele sac through some of its coverings.

4 **Inflammation**—Considering the carelessness with which hydroceles are sometimes tapped it is remarkable that infection occurs so rarely

5 **Transformation into a hæmatocele** is important from the standpoint of diagnosis and will be considered more fully

### HÆMATOCELE

A hæmatocele is formed when the tunica vaginalis is distended with blood. Sometimes it occurs spontaneously



FIG 65 A recent hæmatocele

but is more often the result of injury (fig 65). A common cause is the tapping of a hydrocele. Occasionally a hæmatocele enlarges slowly by repeated hæmorrhages. It is this variety and an old clotted hæmatocele which cause great difficulty in diagnosis. An old clotted hæmatocele (fig 66) often simulates testicular neoplasm in every particular and probably most surgeons of experience have removed a hæmatocele in the belief that they were dealing with a neoplasm. This accounts for the comparatively large number of specimens of old clotted hæmatocele which adorn the shelves of pathological museums.

**Treatment.**—A recent hæmatocele can be treated satisfactorily by aspiration and rest. When the blood is clotted and the diagnosis is assured, turning out the clot followed by excision of the hydrocele sac is the treatment indicated.

### SECONDARY HYDROCELE

Secondary hydrocele is a frequent associate of acute and chronic epididymo-orchitis. It is nearly always present in syphilitic affections of the testis, and is not a rare accompaniment of malignant disease of the organ. Often the question as to whether a hydrocele is primary or secondary to some underlying disease of the testis can only be settled after tapping. Secondary hydroceles rarely attain a large size, and in the case of acute epididymo-orchitis they sometimes subside *pari passu* with the primary lesion.

For *chylous hydrocele*, see Chapter XV.



FIG. 66.—An old clotted hæmatocele. The long-standing pressure has flattened the testis.

### CYSTS OF THE EPIDIDYMIS AND SPERMATOCELES

**Ætiology.**—Certain embryological remnants in relationship to the testes are prone to undergo cystic degeneration. These structures are : .

1. **The Hydatids of Morgagni.**—The pedunculated hydatid is Mullerian in origin (Luschka), while the sessile hydatid is probably derived from the Wolffian duct. The sessile hydatid is said to communicate with the canal of the epididymis (Hochenegg).

2. **The Vasa Aberrentia of Haller** are two in number, the superior and the inferior (fig. 67). Kobelt proved that the inferior one was a remnant of the Wolffian body. The origin of the upper one is disputed : by some it is looked upon as a vas efferens which has lost its communication with the epididymis.

3 The Organ of Giraldes, or Paradidymis (fig 67) is a group of microscopic blind tubules situated in front of the vessels of the cord at the height of the head of the epididymis. This structure is derived also from a part of the Wolffian duct.



FIG 67 —Embryological and other structures from which cysts of the epididymis arise. The sessile and pedunculated hydatids are not shown.

The above embryological remnants account for probably 70 or 80 per cent of cysts of the epididymis—the remainder arise from blocked vasa efferentia.

Dolbeau injected 100 testicles with mercury which caused dilatation of the vasa efferentia. In contradistinction to the rest of the testis and epididymis the vasa efferentia are surrounded by loose connective tissue only. Consequently, it is this part of the sperm conducting mechanism which yields to increased intraluminal pressure.

#### CYSTS OF THE HYDATID OF MORGAGNI

A cyst of the hydatid of Morgagni is a clinical entity which can be diagnosed with precision (fig 68). There is a

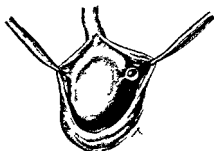


FIG 68 —Cyst of the pedunculated hydatid of Morgagni.

brilliantly translucent cystic swelling, usually about the size of a grape, situated at the upper pole of the body of the testis inclining anteriorly (fig. 69). The cyst is manifestly pedunculated and sometimes undergoes axial rotation (see p. 96).

**Treatment.**—Excision under local anæsthesia is exceedingly simple. Probably treatment by injection would be satisfactory, for the cyst is unilocular. On three or four occasions I have found one of these cysts in the course of a routine examination. Under such circumstances it has seemed advisable to let well alone unless a herniotomy, or other operation in the neighbourhood, has been necessary.

#### CYSTS OF THE EPIDIDYMIS (EXCLUDING THE ABOVE)

Cysts of the epididymis are much more frequent than spermatoceles. I should estimate that the proportion is about ten to one, yet students and practitioners are far more familiar with the term “spermatocele.”

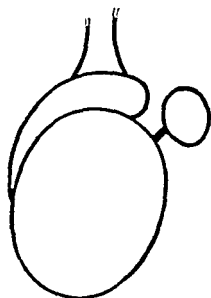


FIG. 69.—Cyst of the hydatid of Morgagni.

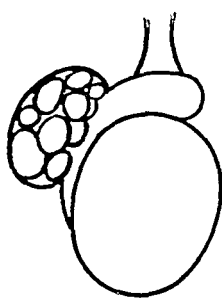


FIG. 70.—Cyst of the epididymis.

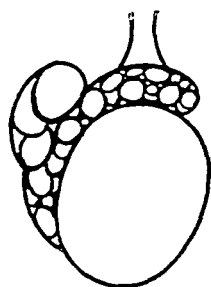


FIG. 71.—Cystic degeneration of the epididymis.

First, let us compare the contents of a hydrocele, cyst of the epididymis, and a spermatocele. Hydrocele fluid is straw-coloured, the fluid from a cyst of the epididymis is crystal clear, while that from a spermatocele is cloudy, like soapy water or barley-water.

These cysts are seldom unilocular (fig. 70). Typical advanced examples show the body of the testis surrounded by a helmet-shaped aggregation of cysts (fig. 71).

**Clinical Features**—Cysts of the epididymis are frequently bilateral and are quite unusual before the age of 40. Unlike a hydrocele the swelling is situated behind the body of the testis (fig. 72). The condition is quite common and it seldom gives rise to symptoms. When large these cysts are tense. They are translucent.

**Treatment**—Only large cysts call for treatment. If a small cyst of the epididymis is giving rise to symptoms a

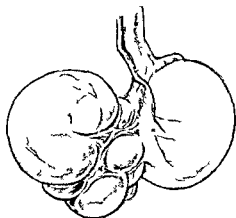


FIG. 7.—Cystic degeneration of the epididymis. Cysts of the epididymis are filled with crystal clear fluid.

possibility of neurosis should be considered. Treatment by injection is usually unsatisfactory for the swelling is an aggregation of small cysts. Local excision yields excellent results. Hæmostasis must be exceptionally thorough for post-operative scrotal hæmatoma is even more prone to occur than after ex-

cision of a hydrocele. When most of the epididymis is affected the best treatment is epididymectomy (Chapter XIV). When undertaking the treatment of these cases one should take into consideration the fact that excision of a cyst does not prevent cystic dilatation of the remainder of the epididymis. Nevertheless I must say that in cases which I have examined several years after local excision there has been no evidence of further trouble.

#### COMPLICATION

Cysts of the epididymis are more prone to attacks of inflammation than hydroceles. Sometimes the inflammation occurs spontaneously; at others it follows tapping or attempts at tapping a multilocular cyst. Occasionally suppuration follows.

I have seen one case of severe suppuration. The patient was admitted with an intensely inflamed scrotal swelling and a temperature of  $101^{\circ}$ . He stated that he was quite well until the day previously, and had not noticed anything amiss with the testicle. Next day the temperature rose to  $103^{\circ}$ , and I decided to explore the swelling. The scrotum was incised, and in the head of the epididymis there was a tense swelling the size of a tangerine orange. On opening this it was found to be full of pus and had a necrotic lining. The greater part of the cyst wall, which was very thick, was excised with a cautery and the scrotum was drained. Rapid recovery followed.

### SPERMATOCELE

A spermatocele is a unilocular retention cyst derived from some portion of the sperm-conducting mechanism of the epididymis and filled with cloudy fluid.

**Ætiology.**—It is not possible to dogmatise upon its exact origin. A blocked vas efferens (fig. 73) would account for the condition: on the other hand, it is impossible to dispute a claim that a spermatocele arises from vasa aberrantia. The other remnants

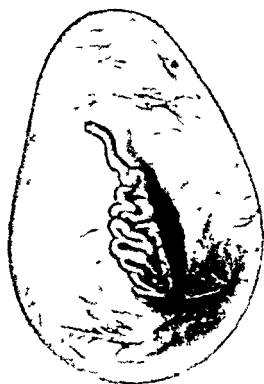


FIG. 73.—A spermatocele with a vas efferens attached. Removed by operation. (After H. C. Rolnick.)



FIG. 74.—A large spermatocele.

hable to undergo cystic degeneration are not in communication with the sperm conducting mechanism

**Clinical Features.**—A spermatocele is nearly always situated in the head of the epididymis, and therefore above and behind the body of the testis. Spermatoceles are relatively uncommon, and they tend to be softer to the touch than other cysts occurring within the scrotum. A positive diagnosis can only be made when the fluid which they contain is examined. This is cloudy and microscopically can be shown to contain spermatozoa, fat globules, lymphocytes, and epithelial cells. While they are translucent, they are inclined not to be so brilliantly translucent as other cysts of the epididymis. Spermatoceles give rise to few symptoms and are usually small and unobtrusive. More



FIG 75.—Cyst of the tunica albuginea (K. J. Frater)

rarely, they are large enough to attract notice. Sometimes the patient presents himself because he believes he has a third testicle (fig 74) but as Sir Robert Liston (1784–1847) remarked “These patients flatter themselves in thinking they are unduly provided”

**Treatment** is seldom called for. If, by aspiration the cyst can be emptied showing that it is unilocular injection should give satisfactory results. Excision is curative.

### CYSTS OF THE TUNICA ALBUGINEA

Cysts of the tunica albuginea are exceedingly rare. Their origin is unknown. Their chief claim to notice is that they have been, justifiably, mistaken for a testicular neoplasm.

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## CHAPTER XI

### AFFECTIONS OF THE PAMPINIFORM PLEXUS

#### VARICOCELE

**Ætiology.**—Right sided varicocele is exceedingly rare, from various statistics it can be computed that not more than 1 per cent of varicoceles are right sided. Bilateral examples are a little more common. It would seem that there must be an explanation why the left side is singled out so regularly, yet proof is lacking. There is a superabundance of theories some of which are highly speculative.

Theories can be summarised under two headings

1 **Absence or Incompetence of Valves in the Left Spermatic Vein**—Valves tend to disappear in the veins as age advances. According to Smirnoff this alone makes the theory ridiculous, for it is common knowledge that varicocele becomes less common in older men.

2 **There is Greater Intravenous Pressure in the Left Spermatic Vein**—For which various explanations are given, among them being

(a) The left spermatic vein opens into the left renal vein at right angles

(b) The pressure in the left renal vein is greater than in the vena cava which receives the right spermatic vein

(c) A loaded pelvic colon tends to obstruct the left spermatic vein

The contributory causes of varicocele are more evident. As in the case of other varicosities, there appears to be hereditary predisposition. All observers are agreed that ungratified sexual excitement is a leading factor in the production of symptoms, and the aggravation of the varicocele.

**Clinical Features.**—Most men have a slight varicocele but where a fullness of the pampiniform plexus ends and a varicocele commences I do not know. The diagnosis of an established varicocele is one of the simplest in surgery (fig 76). It should be noted that when the patient lies

down and the testicle is elevated, the veins will be emptied by gravity. After this has been done, the opportunity for comparing the size of the testis with its fellow should be taken. In long-standing cases of varicocele the left testis is somewhat smaller and softer than the right, and in 12



FIG. 76.—A large varicocele.

per cent. there is appreciable atrophy. The condition is especially common between the ages of 15 and 30 (fig. 77). Eighty-one per cent. of the patients in Barney's series were unmarried. The condition tends to disappear, or at any rate becomes symptomless, after marriage and with advancing years.

Various clinical types of varicocele are encountered in practice.

1. *The Small Varicocele with many Symptoms*.—As Reginald Harrison (1880) remarked: "Strangely enough, often you will notice that the symptoms of varicocele are in no way proportionate to its size. You will find patients with a small varicocele complaining very much, and some large ones occasioning little or no inconvenience." Usually the pain is described as a dull ache—sometimes it is severe, and amounts to testicular neuralgia. In a proportion of the

cases the pain is undoubtedly genuine. If the patient says the pain is excruciating, at once suspect testicular neurosis. Tales of 'lost manhood' and similar talk at once labels

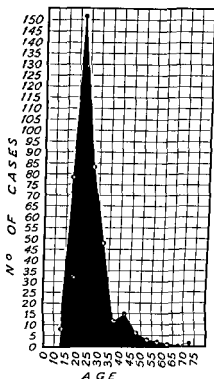


FIG 77—Age incidence of varicocele  
(After Barney)

the case. The patient's facies should be studied. An astute diagnostician can often single out the hypochondriacal patient. Obviously the task before us is to discriminate between 'genuine testicular pain' and what Sir James Paget referred to in this connection as "a mental error not a bodily one that needs cure."

2 *The Moderate sized or Large Varicocele with Moderate Symptoms*—There is a feeling of weight if not actual discomfort especially after standing. Occasionally the testicle is painful and tender, but not continuously.

3 *The Patient wishes to Enter one of the Public Services, but has been Refused until his Varicocele has been Cured*—About 3 per cent of army recruits are rejected on this score.

### COMPLICATIONS OF VARICOCELE

- 1) **Rupture**—I have seen a case where, as the result of a blow the varicocele ruptured and an extravasation of blood occurred in the scrotum. With rest, the effusion was absorbed.
- 2) **Thrombosis**.—Idiopathic thrombosis occurs occasionally. When it comes on acutely it is easily mistaken for torsion of the spermatic cord or acute epididymo orchitis.
- 3) **Hydrocele**.—Possibly varicocele predisposes to a hydrocele.

Certainly an operation for varicocele does so. In a follow-up of 106 cases of varicocele treated by operation, Douglas found that a hydrocele developed in 35 per cent.

### TREATMENT

Views on the treatment of varicocele are divergent. The condition is apt to receive but little attention, but in naval and military circles the efficient treatment of varicocele is a most important matter. I have met surgeons who consider that operative treatment is unjustifiable, and others who look upon the operation as beneath their dignity. The latter is not without significance, for it means that the operation tends to be relegated to the end of the list, to be carried out by the house-surgeon who, as likely as not, has never seen it performed. Crude ligation and division of the larger part of the pampiniform plexus yields poor results. I have seen complete atrophy of the body of the testis as an end result on several occasions, particularly following those cases which were performed during the War. All will agree that indiscriminate operation upon varicocele should be condemned.

Treatment is best considered under three headings :

#### **Palliative Treatment.—**

Cold baths, a suspensory bandage, and a talk with the patient emphasising the fact that the condition tends to get better of its own accord, should first be tried in all cases excepting rejected candidates for the Services.

**Injection Treatment** is often effective in small or moderate-sized varicoceles. One treatment is all that is necessary in most cases.

Technique.—The neck of the left side of the scrotum is shaved and the skin is

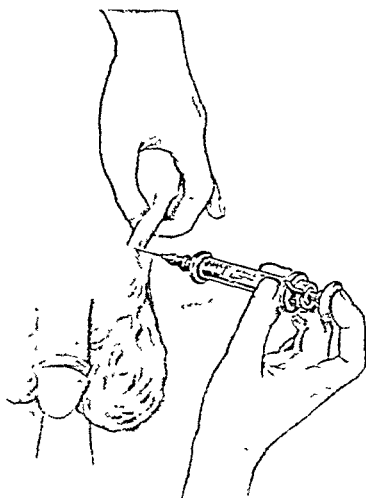


FIG. 78.—The treatment of varicocele by injection.

prepared with picric acid. A wheal of local anæsthetic is introduced into the skin. The patient stands and a small bunch of veins is taken up between the finger and thumb. Using 2 c.c. of 5 per cent solution of sodium morrhuate in a syringe armed with a particularly sharp needle the injection is made from above downwards just below the external abdominal ring (fig 78). The pampiniform plexus is entered at several points by a few short jabs of the needle. The patient lies down and the puncture is sealed with collodion. The pain occasioned by this treatment is often quite severe and there is sometimes a considerable reaction. It is well to keep the patient lying on a couch for an hour, and then advise him to go home and rest for twenty four hours. A suspensory bandage should be worn for a month.

**Operative Treatment.**—In selected cases I have found operative injection treatment of varicocele by the method about to be described very satisfactory.

*Fascial Suspension of the Testis combined with Injection under Vision of the Pampiniform Plexus*—Through an inguinal incision a fascial strip is constructed out of the external oblique. It must be of the correct length to allow the left testis to be suspended at the same level as the right, and it is about half an inch wide and slightly bulbous at the free extremity. It will be seen from the illustration (fig 79) that the fascial strip is left attached to the pubic spine. The incision of the external oblique over the inguinal canal allows thorough exploration for a hernial sac which, if present, is dealt with *secundum artem*. The inguinal canal is closed. The testis is delivered, and various obviously distended radicles of the pampiniform plexus are injected with sodium morrhuate, using a fine hypodermic needle. A little window is cut in the tunica vaginalis displaying the albuginea. This, by the way, will prevent the development of a hydrocele which is so common after other varicocele operations. The bulbous extremity of the fascial strip is sutured to the tunica albuginea, using the finest thread (fig 80). An anchor dressing is applied to the sutured

skin incision, and a bridge of adhesive plaster supports the testicles until the wound has healed. No after-treatment is necessary ; indeed, the use of a suspensory bandage is to be discouraged. In the only instance where some pain was complained of, when I saw the patient three months after his operation. I found him wearing a sus-

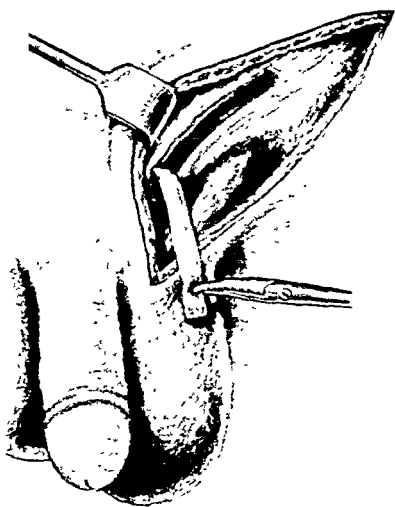


FIG. 79.

Method of suspending the testis with fascia in the treatment of varicocele

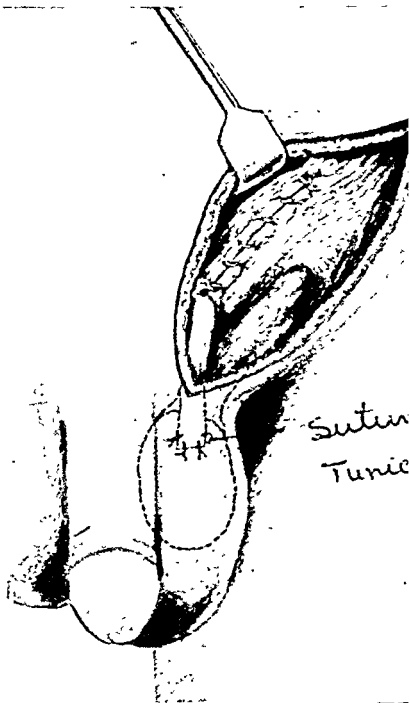


FIG. 80.

pensory bandage. A month later, after discontinuing the support, he stated that he had been entirely free from symptoms.

**Alternative Operative Procedures.**—A bewildering variety of operations for varicocele have been described. I propose to include but one which, before adopting the fascial suspension method, I considered to be the best—that evolved by M. F. Campbell.

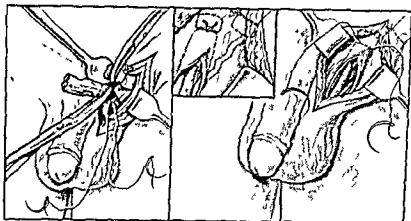


FIG. 81.—An operation for varicocele. The distal stump is suspended through the external abdominal ring as is shown in the right hand figure. The inset shows the relationship after the suspension ligature has been tied. (After M. F. Campbell.)

**Technique**—The cord is exposed by a short incision over the external abdominal ring. A little more than three quarters of the circumference of the pampiniform plexus is separated from the remainder lying in the proximity of the vas. The isolated venous mass is divided between clamps and the proximal end securely ligatured using a transfixing suture. The proximal end is now allowed to fall back and it retracts within the inguinal canal. An inch and a half or more of the distal end is resected and ligatured. The ends of the ligature are left long and passed through the aponeurosis of the external oblique from within the external abdominal ring as shown in Fig. 81. The testis is suspended and the skin incision is closed. This method is preferable to others as it prevents drag on the spermatic cord. In cases where the scrotum is pendulous an elliptically shaped portion of its base is resected and the cut edges approximated. The now compact left scrotal compartment aids in supporting the testis from below.

The chief post operative complication—the development of a hydrocele—is mitigated by avoiding rough handling of the testis during the operation.

### SECONDARY VARICOCELE

A comparatively rapid onset of a varicocele especially in a patient no longer young is suggestive of a renal (fig. 82) or an adrenal tumour. The kidney region should be palpated in such cases and a cystoscopic and pyelographic



investigation of the kidney is imperative. Sir Henry Morris first described the phenomenon, which is a rare one. To quote Sir Henry: "In 1884 I drew attention to a varicocele which had appeared and gradually increased with the growth of a left adrenal malignant tumour. I have since then seen varicocele associated with a cancer of the right kidney, which disappeared on the second day after nephrectomy."

### INGUINAL VARICOCELE

According to C. B. Lockwood, the condition gives rise to the following signs. There is a slight swelling in the region of the left inguinal canal, which is greater when the patient stands up. There is a distinct impulse on coughing. The swelling disappears when the patient lies down, but slowly. The condition is due to varicosity of the spermatic veins in the inguinal canal, and it may, or may not, be associated with an obvious scrotal varicocele.

The treatment recommended by Lockwood is to open the inguinal canal and excise the veins.

### ENDEMIC FUNICULITIS

The essential pathology of this condition, so named by Sir Aldo Castellani in 1908, is a thrombo-phlebitis of the pampiniform plexus. Endemic funiculitis is fairly common in the East, but it is not unknown in Europe. Although visitations are especially common in the spring and early summer, it occurs all the year round. Young men are the usual victims.

**Ætiology.**—Castellani believes the condition to be a filarial disease with a superadded streptococcal infection. In fulminating cases, a hæmolytic streptococcus can be isolated from the blood (Ray).

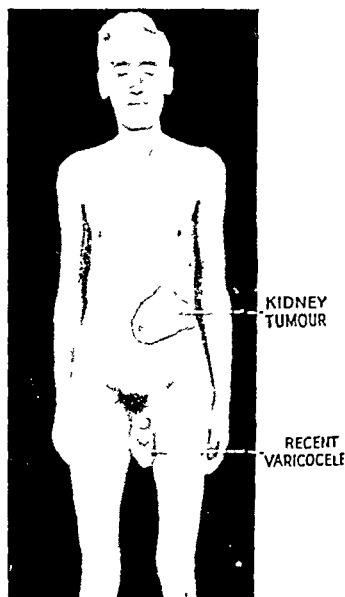


FIG. 82.—Secondary varicocele associated with a Grawitz tumour of the kidney. After the kidney had been removed, the varicocele disappeared within three weeks.

## ACUTE SUPPURATIVE FUNICULITIS

Acute suppurative funiculitis usually starts suddenly with rigors, vomiting and a high temperature. The spermatic cord soon becomes greatly swollen and tender. The local inflammation goes on rapidly to suppuration, and in the severer types may spread to the retroperitoneal cellular tissues. The testicle is usually only slightly enlarged though extremely tender. As a rule, there is little or no effusion into the tunica vaginalis at this stage. The inflammation proceeds apace and septicæmia soon follows. Pyæmia is usual. While abscesses may develop in any situation, there is a predilection for the knee joint.

**Treatment.**—There is no tendency to spontaneous recovery. The only hope lies in urgent operation. The pampiniform plexus is laid bare by a long scrotal incision, the constituents of the cord are separated and the wound left open. Antiseptic dressings are applied. Blood transfusion and other methods of mitigating general septicæmia should prove useful.

## ACUTE NON-SUPPURATIVE FUNICULITIS

This is the more common variety of the disease. The onset is as sudden as in the suppurative variety, but the constitutional symptoms do not amount to more than a slight degree of fever. There is induration and swelling of the spermatic cord and the veins can be felt thrombosed. It is rarely necessary even to confine the patient to bed. The condition is not progressive. Slow absorption begins about the end of the first week, and by the end of the third week the infiltration has nearly cleared up, leaving the spermatic cord only slightly more fibrous than before.

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## CHAPTER XII

### TORSION AND TRAUMA

#### TORSION OF THE TESTIS

SOME consider it more accurate to call the condition torsion of the spermatic cord

**Ætiology.**—Torsion cannot occur in a normal testis two anatomical peculiarities must be present (1) Absence of the scrotal ligament (V Bonomo) By the scrotal liga-

ment is meant that fine anchorage of the epididymis to the posterior scrotal wall (2) A complete and high investment of the testis and epididymis by the tunica vaginalis These two anatomical anomalies cause the testis and its adnexa to hang in the vaginal cavity like the clapper of a bell (fig 83) The digitations of the cremaster muscle are

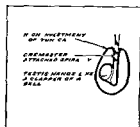


FIG 83 The predisposing causes of torsion

attached to the cord spirally and when this muscle contracts vigorously it will be understood how rotation of the clapper is initiated

There is no known actual exciting cause of torsion To illuminate this statement it is only necessary to say that in six cases investigated by H A Johnson three occurred during sleep one after coitus one after jumping from a truck and one while lifting a heavy weight above the head

**Pathology** —So often does torsion occur within a commodious tunica vaginalis that the very existence of extravaginal torsion is doubtful The twist usually takes place in the long axis of the spermatic cord and it varies from half to

four complete turns, which are nearly always from without, inwards. The immediate result of the volvulus is that the testicle is deprived of its blood supply. Hæmorrhagic infarction occurs; the organ assumes a dark purple hue (fig. 84). and there is an outpouring of sero-sanguineous fluid into the tunica. Aseptic gangrene soon follows, and unless early untwisting or orchidectomy is performed, complete atrophy of the testis results eventually. A less fortunate turn of events is infection of the gangrenous tissues—how often this would occur if



FIG. 84.—Torsion of the testicle, removed from the inguinal canal of a boy of 15.

gangrenous organs were not extirpated is difficult to estimate—perhaps a conservative estimate would be about 30 per cent.

It has been noted by several observers that the twisted testicle is inverted, i.e. the hydatid of Morgagni is below. This is in keeping with what we might expect—twisting only occurs in an anatomically imperfect organ.

**Clinical Features.**—It is commonly believed that torsion is almost a prerogative of a testis which is incompletely descended. That it occurs *relatively* frequently in mal-descended testes there is no doubt, but I am sure the incidence is slightly greater in fully descended, but anatomically imperfect, organs.

No age is exempt; the earliest case occurred in an infant four hours after birth (Taylor). One of the oldest was Lexer's patient, who was 63. The bulk of cases, however, occur during the ten years following puberty.

The onset is sudden, and when the twist is a tight one the pain is agonising, causing the patient to collapse. Vomiting is a common accompaniment. Pain and difficulty in micturition are sometimes present. As gangrene of the testis sets in, which it does in about six to twelve hours, the agonising pain passes off and the patient's temperature, which previously was normal or subnormal, becomes slightly elevated (99° F). The diagnosis of torsion of the testis is seldom easy. Acute epididymo orchitis and strangulated inguinal hernia are the conditions with which it is most often confused. In order to paint a true clinical picture, we must consider three types of testicular torsion.

### 1. TORSION OF THE FULLY DESCENDED TESTIS

Even when the patient is examined soon after the attack, the scrotum is swollen. On palpation the testis is enlarged and exquisitely tender, so great is the tenderness that further examination may be impossible. A secondary blood stained effusion into the tunica vaginalis is usually present.

The cord is thickened and on rare occasions it is possible actually to feel the twist.

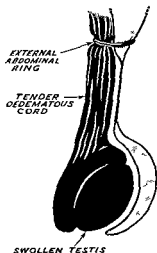


FIG 85—Explanation of how a small strangulated hernia may cause testicular symptoms by pressure on the cord.

### Differential Diagnosis

(a) **From Strangulated Hernia.**—Even the signs of torsion of a completely descended testis are occasionally mimicked by a strangulated inguinal hernia when the sac is small, very tense, and situated in the upper part of the inguinal canal. This brings about compression of the veins of the spermatic cord, and swelling and tenderness of the testis results (fig 85).

(b) **From Epididymo-orchitis.**

—When the patient is first seen after the early agonising symptoms have abated torsion of the testis seems to be mistaken regularly for acute epididymo-orchitis (fig. 86). The main reasons for this persistent error are that the scrotal skin becomes reddened and inflamed and the patient's temperature is slightly elevated. The history of an extremely sudden onset and the absence of a urethral discharge should make the differential diagnosis tolerably simple. Prehn describes the sign which, on occasion, may prove successful.



FIG. 86.—Torsion of the testis in a boy of 14 twenty-four hours after onset. The inflamed and tender scrotum simulates closely epididymo-orchitis.

*Prehn's Sign.*—If the case be one of epididymo-orchitis,

elevation and support of the scrotum by a bandage for an hour will relieve the pain.

## 2. TORSION OF A MALDESCENDED TESTIS IN THE INGUINAL CANAL

It is practically impossible to distinguish torsion of a maldescended testis from a strangulated inguinal hernia. The fact that the side of the scrotum is empty and œdematous is certainly in favour of the tender lump at the external abdominal ring being the testis with its cord twisted, but it is impossible to rule out a tense strangulated inguinal hernia until the parts have been displayed by operation.

## 3. TORSION OF AN INTRA-ABDOMINAL TESTIS

I have several times made a tentative diagnosis of this condition in relevant cases, i.e. an empty scrotum on one side, only to find on opening the abdomen that the diagnosis was wrong! There are only about one dozen examples of intra-abdominal torsion recorded, but as several surgeons I know have met with cases, it is probable that the condition

is not so excessively rare as the paucity of published cases would indicate. In three of the recorded cases the twisted intra abdominal testis was the seat of a malignant growth.

### TREATMENT

When the diagnosis of torsion is tolerably certain and the patient is seen early in the attack, manipulation should be attempted.

Sometimes, in cases of recurrent mild torsions, the patient learns to untwist the testicle himself.

Rigby and Howard's instructions for untwisting an early torsion are as follows. The testis is supported in the hand and first twisted from *within, outwards*. If this increases the pain and the testis will not stay in the new position it should be twisted from without, *inwards*.

W. G. Nash succeeded in untwisting the testis one hour after the onset of acute torsion in a boy of 19. Half an hour later all symptoms had abated. The testis was normal in size, and all that remained was some tumefaction of the cord. In spite of this prompt and effective treatment, two years later the testis had undergone complete atrophy.

#### R. E. Smith's case

A schoolboy at Rugby was awakened at 5.30 a.m. with excruciating pain referred to a point one third along a line joining the anterior superior iliac spine to the umbilicus. He was very restless and writhing in agony at 6.45 a.m. The right testicle was the size of a hen's egg, and moderately tender. On rotating his testicle 180 degrees from his left to right he volunteered the statement 'That's better,' but it required a further 180 degrees before complete relief was obtained. He was left to hold the testicle in position for an hour. Three hours later the testicle was normal in size.

In later cases, or when manipulation is not quickly and entirely satisfactory, the testis should be exposed through an inguinal incision. The testis is delivered through the wound. If, on untwisting the cord, there are any signs of a return of the circulation, an attempt should be made to preserve the organ and to fix it by sutures in an anatomically correct position (p. 96). Experience teaches us that in the majority of instances when untwisting has been performed after the sixth hour atrophy of the testis ensues.



eventually, although it takes several months to become manifest. Therefore, if the testis appears blue-black and lifeless, the best course is to ligate the cord and remove the useless organ.

### RECURRENT TORSION

Recurrent torsion with spontaneous rectification occurs. I met with such a case in a young soldier. On the occasion upon which I saw him—the fourth attack within six months—spontaneous rectification took place in the jolting ambulance which conveyed him from his camp. As a result of the repeated interference with its blood supply, the affected testis had become much smaller than its fellow.

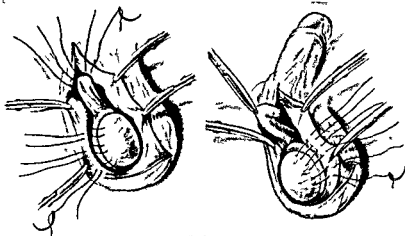
### RECURRENT AND BILATERAL TORSION, WITH SPECIAL REFERENCE TO PREVENTION

If a testis has undergone torsion once and has reduced itself or has been untwisted, it is highly probable that it will twist again at some future date. It is foolhardy to neglect measures to prevent a repetition. Furthermore, it seems reasonable to assume that if the “clapper of a bell” anomaly is present on one side, it is not unlikely that the anomaly is present on the other side also. Consequently, if the patient has lost one testis through torsion, it seems wise to explore the contralateral side at a convenient time and to rectify the anomaly if present. Simultaneous bilateral torsion is unknown, but examples where torsion on one side has been followed by torsion on the other are on record. In Kenneth Walker's case the interval between left and right torsion was only four weeks after orchidectomy for torsion. I have explored the contralateral side in three instances—in each case the testicle was anatomically perfect. This experience would not deter me from continuing the practice.

### An Operation for Fixation of the Testis

The following method, described by E. J. Ottenheimer and C. Y. Bidgood, is effective. An oval piece of the redundant scrotum is removed. The tunica vaginalis is opened, everted, and stitched behind the epididymis. The cord is freed. Re-

dundant cord is pushed into the inguinal canal until there is no excess in the scrotum. It is then anchored by interrupted sutures at the external abdominal ring. Mattress sutures of fine silk are used to fix the tunica albuginea to the wall of the scrotum on the one hand (fig 87) and to the septum



FIGS 87 AND 88 —Method of anchoring the testis with sutures to prevent recurrence of torsion. FIG 87 Lateral mattress suture. FIG 88 Medial mattress sutures through the septum dartos. The sutures are passed in each case through the tunica albuginea. Fine silk or thread is the best material to employ in order to make the anchorage permanent.

dartos on the other (fig 88). These sutures penetrate the tunica albuginea 5 cms in front of the epididymis. All of them are placed before they are tied. This anchors the back of the testis firmly to the inner lining of the scrotum. Intrascrotal rotation of the testis is thenceforth impossible.

#### TORSION OF AN APPENDAGE OF THE TESTIS

The pedunculated hydatid is definitely liable to undergo axial rotation (fig 89), possibly on rare occasions other vestigial structures related to the epididymis also undergo torsion. G. H. Colt reported the first case of torsion of a pedunculated hydatid in 1922. Since then many cases have been published.

**Clinical Features.**—As opposed to torsion of the testis, this condition appears to have a definite age incidence. It occurs almost invariably in boys about the age of puberty. The symptoms are precisely those of torsion of the testis, but milder. On the whole, the diagnosis is not so difficult, for a tender grape-like swelling can be made out at the upper pole of the testis. Many cases have been, and still are, overlooked; they are assumed to be examples of epididymo-orchitis of unknown origin. The careful clinician should be wary of this trap, and argue as follows: Apart from the orchitis of mumps, acute epididymo-orchitis is rare in young boys, at any rate in temperate climates; whereas torsion of the appendage of the testis cannot be so exceedingly unusual, for Mouchet, in France, who has been interested in this condition for many years, has operated personally upon thirteen cases. Therefore, if a boy gives a history that, following a sudden attack of pain, one side of the scrotum has become swollen, providing the urine is normal and there is no suggestion of an infection such as mumps to cause the acute epididymo-orchitis, torsion of the testis or torsion of an appendage of the testis is the probable diagnosis.

**Treatment.**—Treated expectantly, torsion of the hydatid of Morgagni runs rather a painful course, accompanied often by pyrexia, but eventually resolution occurs in all cases. Immediate operation with the removal of the twisted appendage—a measure of the utmost simplicity—terminates the symptoms abruptly.

#### INJURIES AND LACERATIONS OF THE TESTIS

Blows on the testicle are accompanied by great pain and shock.

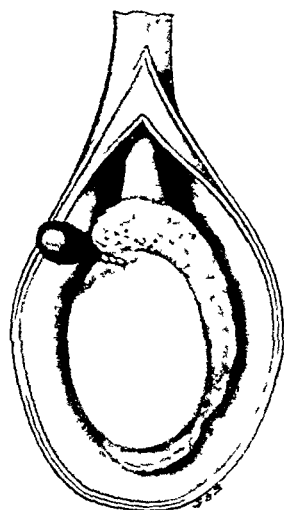


FIG. 89.—Torsion of the pedunculated hydatid of Morgagni. (After Foshee)

**Hæmatocele**

Traumatic hæmatocele has been discussed on p. 72

It is generally wise to explore a large recent hæmatocele when the integrity or otherwise of the testis will be manifest

**Lacerated Testis**

Even when the damage is severe repair is possible as is well shown by the following case described by F. J. Cotton

A man was hit on the scrotum whilst playing baseball. Excruciating pain and shock resulted and this was soon followed by the development of an enormous scrotal hæmatoma. The testis was exposed and after blood and blood clot had been swabbed away a fragmented testis which looked as if it had exploded under the swift impact was displayed. The tissues were sewn up layer by layer and the wound was closed without drainage. The scrotum was supported by light pressure. Convalescence was uneventful.

**Dislocation of the Testis**

Traumatic dislocation of the testis is an unusual accident most often due to the wheel of a vehicle passing over the genital region. The testis is squeezed out of the

scrotum into some abnormal position and there it stays. Bruising and extravasation of blood mask the condition and it is seldom recognised until some weeks after the accident. By this time the organ has become anchored firmly to its new surroundings.

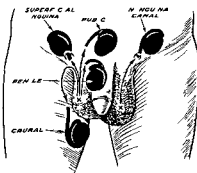


FIG. 90—Varieties of traumatic dislocation of the testes. (After Alyea.)

In order of frequency a dislocated testis has been found in the following locations (fig. 90)—over the pubis, superficial to the inguinal canal, under the skin of the shaft of the penis, in the perineum, in the inguinal canal and in the thigh. In the only case I have seen the testis had been driven under the skin of the penis.

**Treatment.**—If the condition is recognised early, no doubt the testis could be manipulated into the scrotum. As it is, the majority of cases require operative replacement, which is simple and eminently satisfactory.

### Compound Dislocation of the Testicle

The testis prolapses through the lacerated scrotum (fig. 91). This is a fairly common industrial accident, and the treatment follows ordinary surgical principles.

E. S. Pomeroy's case.

A coal-miner fell from a coal car, and the mule stepped on his scrotum. The force of the mule's weight exploded the right testicle completely through the scrotum. The organ itself and its cord were uninjured, and, after cleansing, it was replaced. An interesting feature of the case was that the wound of emergence would not permit replacement of the testicle until it had been widened considerably with a scalpel.

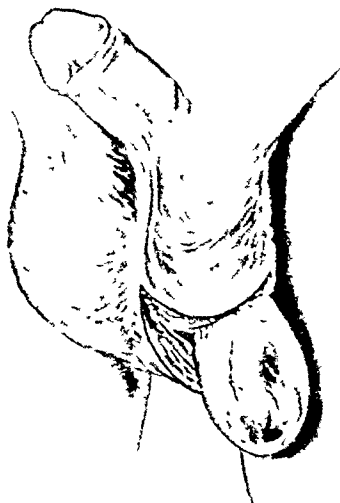


FIG. 91.—Compound dislocation of the testicle. (After Alyea).

### Traumatic Orchitis

No account of injuries to the testicle would be complete without a reference to traumatic orchitis. The condition, if it exists at all, which is doubtful, is at any rate exceedingly rare, yet every patient with epididymo-orchitis ascribes the condition to a blow or a strain. Touching on this point, M. C. Wesson analysed seventy cases of "traumatic orchitis"; only two could be attributed to trauma, and in each of these there was a definite hæmatocele. One was a case of torsion in which an injury seemed relevant; the remainder were cases of epididymo-orchitis, many of them gonococcal in origin. Thus, I think we may take it that "traumatic orchitis" is largely a myth.

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## CHAPTER XIII

### ACUTE EPIDIDYMO-ORCHITIS

BEFORE undertaking a consideration of this important subject it is advisable to dwell upon three fundamental points.

1. It is unprofitable and confusing to attempt to segregate epididymitis from orchitis. The condition will be referred to as epididymo-orchitis. Besides being convenient, in most instances this term is scientifically accurate.

2. Nearly every patient with epididymo-orchitis seems to attribute the condition to a strain or a blow. The fact that traumatic epididymo-orchitis is excessively rare, if not unknown, needs further emphasis.

3. Gonorrhœa is the commonest cause of epididymo-orchitis, but it is a great mistake to jump to a conclusion that a given case is necessarily gonococcal. An attempt should be made early to isolate bacteriologically the infecting organism.

**Ætiology.**—In some instances, e.g. the epididymo-orchitis of mumps, infection is undoubtedly blood-borne. Possibly, in a few instances, organisms are carried to the epididymis via the lymphatics, but there can be no question that in the majority of cases infection arrives via the vas from the posterior urethra.

How retrograde infection actually reaches the epididymis is a matter for speculation. The combined length of the common ejaculatory duct and the vas is 47 centimetres. It is difficult to understand how organisms traverse this path in a matter of hours. Reversed peristalsis in the vas is the usual explanation, but there is another possibility which fits in with the facts admirably. While performing vasectomy Belfield noticed that occasionally a drop or two of urine escaped from the proximal cut end of the vas. Presumably regurgitation of urine along the vas occurs fairly regularly when the bladder is full, and this would account for rapid transference of bacteria from the posterior urethra to the epididymis.

**Clinical Features.**—The attack is inaugurated by malaise, pyrexia, and perhaps a rigor. The testicle becomes swollen and acutely tender, and a sympathetic acute hydrocele is a frequent accompaniment. In the premonitory stages when inflammation is proceeding along the vas deferens, pain may be referred to the abdomen, and on the right side this has been mistaken for appendicitis.

### GNOCOCCAL EPIDIDYMO-ORCHITIS

Gonococcal epididymo orchitis is probably the most common disease of the testicle. It occurs frequently during the second or the third week of gonorrhœal urethritis infection. Usually the onset is acute, the pain excruciating, and the patient welcomes his bed. An associated urethral discharge suggests the diagnosis, demonstration of the gonococcus confirms it. Infection of the posterior urethra, the prostate, and the seminal vesicles precedes the epididymo orchitis in all cases. In the presence of infection of the posterior urethra too forceful injections, the passage of instruments, vigorous prostatic massage and sexual or alcoholic excess may incite the epididymo orchitis. The condition is bilateral in about 10 per cent of cases, when unilateral, the right side is slightly more often involved.

**Pathology.**—The disease, in its early stages, is confined mainly to the globus minor, and when the infection is mild it is limited to this part. When it is severe the infection involves the whole of the epididymis, and suppuration is usual. While the disease is confined mainly to the epididymis, in severe cases the body of the testis is involved and occasionally abscess formation occurs here.

**Treatment.**—In all cases urethral irrigation must be stopped. Local treatment to the posterior urethra should be withheld for at least three weeks and then commenced with the greatest caution.

*In mild cases* ambulatory treatment can be considered, a jock strap or a Bellevue bandage being used to support the inflamed testicle.



*In Cases of Average Severity.*—When there is even a slight elevation of temperature the patient should be confined to bed. The scrotum is supported on a scrotal bridge and ice applied. The bowels should be emptied with an enema, and a sedative administered. After six to twelve hours hot fomentations are substituted for the ice, and the heat will be found to be more soothing.

**Intravenous Calcium Therapy.**—Remarkable relief from pain, and often reduction in the signs of local inflammation, follow the intravenous injection of 5 c.c. of a 5 per cent. solution of calcium chloride. Capsules of the solution are obtainable ready for intravenous injection. The chief symptom following the injection is a sense of heat all over the body, but this lasts only for a few moments. The injection must be made slowly. Two or three days later a second intravenous injection of 7 c.c. is given, and this is followed by one of 10 c.c. four days later. Calcium gluconate has the advantage that it is somewhat less toxic than calcium chloride.

If the general and local symptoms subside under the above regime, and they usually do, the patient can get up after a Bellvue bandage has been applied. This should be worn until a week after resolution has occurred.

**Operative Treatment** (see p. 106).—Some consider that operation is indicated only when a local abscess has formed ; others advocate early operation in all severe cases which do not respond quickly to conservative measures. M. F. Campbell, whose experience in this condition is large, considers that about one in fifteen cases require operation, and this appears to be reasoned judgment, avoiding the extremes of ultra-conservatism and ultra-radicalism.

\* \* \* \* \*

When the attack of acute epididymo-orchitis has subsided treatment of the concomitant vesiculitis or prostatitis should be instituted—at first cautiously. Unless the infection is eradicated the epididymo-orchitis will, in all probability, recur.

## EPIDIDYMO-ORCHITIS OF MUMPS

When mumps attacks males above the age of puberty epididymo orchitis is a common complication approximately one-fourth of these subjects being affected. Occasionally testicular manifestations precede the salivary, or the latter may be absent altogether. Sometimes swelling of the submaxillary salivary gland or glands, as opposed to the parotid, partners the epididymo orchitis. As a general rule, the testicular complications commence one week after the onset of the disease, which coincides with the waning of the parotid swelling.

**Clinical Features.**—As soon as the testis is attacked constitutional symptoms are ushered in. There is pyrexia, shivering, sometimes vomiting, and even delirium. Occasionally there is a slight urethral discharge, which is sterile. The testis increases in size rapidly, and is very tender. It is not always, however, very painful and some patients become exceedingly ill without giving a hint that they are suffering from any local complication. The inflammation seldom lasts more than three or four days. The swelling subsides as rapidly as it appeared. Resolution nearly always occurs. The other testis becomes involved in approximately one third of the cases. When the condition is unilateral it is said that the right side is more often attacked.

**Pathology.**—"Orchitis of mumps" is generally conceded to be mainly, if not entirely, limited to the body of the testis, i.e. an orchitis pure and simple. It is, therefore, instructive to learn what C. G. Smith found in two cases where he explored the organ in the height of the attack—findings which emphasise the wisdom of refraining from referring to orchitis apart from epididymitis. At each operation, on opening the tunica vaginalis there was an escape of about one ounce of turbid yellow fluid. The testis was enlarged considerably, its colour bluer than normal, and punctate hæmorrhages were scattered over the tunica albuginea. *The*

*epididymis* was deep red, and the *globus major* almost black. The cord was somewhat œdematous and the vas normal. A piece removed for histological scrutiny showed signs of acute inflammation. No bacteria could be isolated.

**Orchitis of Mumps and Testicular Atrophy.**—Authorities on mumps have stated that atrophy is rare, basing their figures on an examination of cases a few months after the attack. Testicular atrophy takes time to become manifest ; it is not until eighteen months or two years after the attack that one can pronounce whether or no the seminiferous mechanism has escaped serious damage. From evidence collected from various sources, it is quite clear that in fully 55 per cent. of cases the testicle becomes seriously, if not completely, atrophic.

**Treatment.**—So regularly does this serious inflammation of the testicle subside as dramatically as it began with no treatment other than rest, that it is difficult to plead for anything but masterly inactivity. If, however, one ponders upon the living pathology during the acute attack and the small army of possessors of atrophic testicles following this complication, it should be clear that decapsulation of the epididymis (p. 107) would probably prevent this minor catastrophe. The operation is without danger to life, it relieves the severe pain immediately, and, in my opinion, is more than justifiable. It is exceedingly difficult to persuade those who treat mumps as to its advisability, and consequently there is no statistical proof of the efficacy of operative treatment.

Acute metastatic epididymo-orchitis also complicates, but less frequently, scarlet fever, typhoid fever, small-pox, and influenza. Of these the typhoid group requires some special mention.

#### TYPHOID AND PARATYPHOID EPIDIDYMO-ORCHITIS

Typhoid orchitis tends to suppurate. Of 2,500 cases of the typhoid group analysed by Sir A. E. Webb-Johnson, four patients developed epididymo-orchitis. All of them were of the paratyphoid group, and in each instance the patient had bacilluria.

### B. COLI EPIDIDYMO-ORCHITIS

It is, of course, probable that in the majority of cases the infection is an extension from the prostatic urethra. In other words, the epididymo orchitis is a complication of *B. coli* prostatitis or vesiculitis. Sometimes the condition occurs idiopathically, especially in individuals run down with overwork. Heitz-Boyer considers that in a number of these cases the testicle becomes infected via the blood stream from the bowel without urethral infection. When the infection is acute constitutional symptoms are often exceptionally severe. Suppuration is not uncommon.

H. M. King describes the case of a base ball player who became infected after intercourse with his wife, who at the time had just made a clinical recovery from a serious *B. coli* infection of the urinary tract. The temperature rose to 103.5 and an abscess of the epididymis was drained.

### STAPHYLOCOCCAL EPIDIDYMO ORCHITIS

Acute staphylococcal epididymo orchitis usually develops in the course of a general staphylococcal infection. The chronic form is an important differential diagnosis from tuberculosis (see Chapter XIV).

### ACUTE TUBERCULOUS EPIDIDYMO-ORCHITIS (see Chapter XIV)

### ACUTE POST-OPERATIVE EPIDIDYMO-ORCHITIS

Previously this was a serious and frequent complication of prostatectomy. Preliminary vasectomy prevents its occurrence.

### THE OPERATIVE TREATMENT OF ACUTE EPIDIDYMO-ORCHITIS

Unless abscess formation makes it imperative, operative treatment for acute epididymo orchitis is seldom undertaken in England.

My own introduction to this form of therapy was as follows. A few days previously I had been reviewing decapsulation of the epididymis when I was asked to see a young man with very acute epididymo orchitis. Eighteen months previously he had had a similar attack on the other side, and that testis had sloughed entirely. The infecting organism proved to be the *B. coli*. Naturally there was concern lest the sole remaining testis should follow suit, especially as this attack was even more severe than the previous one. I decapsulated and drained the epididymis. The result was

so dramatic—the pain was relieved immediately and within ten days the wound had healed—that I have since often used the method.

The principal arguments in favour of operative treatment are as follows :

1. At the height of the attack the suffering is agonising. Decapsulation of the epididymis abolishes acute pain at once.

2. Decapsulation, by relieving tension, prevents necrosis of the tube of the epididymis and the possibility of male sterility is minimised.

3. In many cases the rapidity of the convalescence is enhanced.

The indications for operative treatment are still largely a matter of individual judgment. In general, it can be stated that in a severe case of epididymo-orchitis, if treatment by rest in bed with the organ supported does not prove beneficial within forty-eight hours, operative treatment is more than justified.

Again, the exact form of the operation is not absolutely defined. Most of the operative measures advocated have their uses. Local anæsthesia is used unless the cord and vas are involved, when spinal or general anæsthesia is to be preferred. The organ is exposed through a lateral incision in the outer side of the scrotum, exposing the entire epididymis and the cord for 2 inches.

**Simple Decapsulation** (*syn.* **Decortication**).—A cruciform incision is made through the thickened and inflamed coverings of the epididymis, which are prised off the underlying sperm-conducting mechanism (fig. 92). The tunica vaginalis, if distended with fluid, is also incised. The scrotal wound is closed with

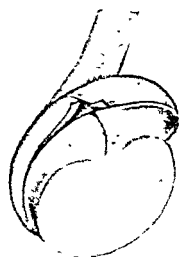


FIG. 92.—Decapsulation of the epididymis by a cruciform incision.

drainage and the testes are elevated once more on a scrotal bridge. Simple decortication appears to be the method of election in cases of severe gonococcal epididymo-orchitis,

and it is this method which should be tried in the epididymo orchitis of mumps

**Decapsulation Combined with Puncture**—If suppuration is suspected multiple punctures are made in the epidid

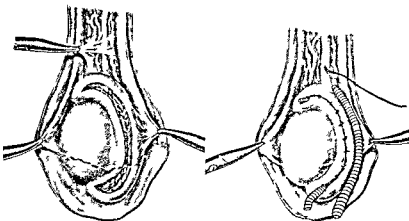
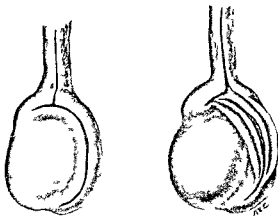


FIG 93 —Decapsulation by Turner's technique For description see text

dymis after it has been decorticated This is sometimes known as Hagner's operation

**Decapsulation by Turner's Technique** (Fig 93) is I think the best routine operation especially when the organism is one which is known to lead frequently to abscess formation

e.g. *B. coli*. After exposing the testis the operation is conducted in three stages.

*Step 1.*—The epididymis is freed from adhesions and the cord is separated from its bed. The vas is punctured and catheterised with a strand of silkworm gut. If the vas is patent and no pus exudes, its sheath is closed with a fine catgut suture. If pus is present the silkworm gut is left in place and brought out through the skin at the upper angle of the wound.

*Step 2.*—When a secondary hydrocele is present it is incised. This is done through a simple longitudinal incision at a point opposite the epididymis.

*Step 3.*—An incision is made over the entire epididymis, which is separated from its sheath by blunt dissection. The epididymis is probed systematically with a sharp instrument in search of an abscess. A piece of rubber drain is inserted and the sheath united over the drain. The wound is closed and the drain is removed on the third or fourth day.

A summary of the indications for operation in acute epididymo-orchitis is as follows :

1. When severe pain persists after forty-eight hours of palliative treatment.
2. In bilateral cases.
3. In recurrent cases.
4. When resolution of the inflammation is unusually slow.

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## CHAPTER XIV

### TUBERCULOUS EPIDIDYMO-ORCHITIS

#### ACUTE TUBERCULOUS EPIDIDYMO-ORCHITIS

GENITAL tuberculosis commences acutely sufficiently often to render the tubercle bacillus being considered a possible causative agent in those cases where the nature of the infection is not apparent. Of 509 cases of tuberculous epididymo-orchitis reported by T. Sjostrand sixty-eight commenced acutely, and this may be taken as a representative series. To diagnose acute tuberculous epididymo-orchitis with assurance at the first visit is impossible. E. L. Keyes wisely dictates that when spontaneous infection suggests tuberculosis one must beware of accepting the suggestion until three months have elapsed, unless confirmatory evidence, such as the presence of tubercle bacilli in the urine, is forthcoming.

#### CHRONIC TUBERCULOUS EPIDIDYMO-ORCHITIS

The male sperm-conducting mechanism is attacked by tuberculosis most often during the years of greatest sexual activity; 75 per cent. of cases occur between the ages of 20 and 40. The disease is by no means unknown, but it is comparatively rare, in childhood. Cases have been reported during early infancy. The diagnosis of chronic tuberculous epididymitis is usually not difficult. The craggy epididymis and thickened vas (fig. 94)

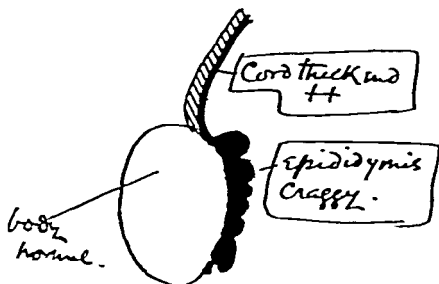


FIG. 94.—The physical signs recorded in a typical case of tuberculous epididymo-orchitis.

present a classical picture which is often unmistakable (See also p 55)

More often than not pain is absent, when it occurs it is referred to the cord or to the groin. Unless there is a major extra genital lesion, loss of weight is slight or absent.

**The Vas.**—It has been said, with considerable justification, that unless there are evidences of thickening or beading of the vas the patient is not suffering from tuberculosis. This is a diagnostic point which is accepted generally. However,



FIG 95.—A discharging sinus in the scrotum complicating a case of genital tuberculosis

in ten consecutive cases of beading of the vas A R Stevens found that seven were tuberculous and three were non tuberculous

**Scrotal Sinuses.**—Later in the course of the disease a sinus or sinuses are wont to develop, nearly always posteriorly (fig 95) in relationship to the normally placed epididymis. In about 25 per cent of cases the patient has a scrotal abscess or a fistula when he first presents himself. Not uncommonly he states that the fistulous tract discharges purulent fluid for a while, closes, and then reopens. One

would suppose that the prognosis in suppurating cases is much worse, but this does not prove to be the case. The disgusting sinus leads the patient to take better care of himself (Keyes).

**Secondary Hydrocele.**—Excluding the acute form, secondary hydrocele is not a frequent accompaniment of genital tuberculosis. It has been estimated that a hydrocele is present in 30 per cent. of cases.

**Rectal Examination.**—As an integral part of the routine clinical examination, the prostate and vesicles will be palpated. An obviously palpable lesion in one of these organs, usually in the corresponding vesicle, is found in a high percentage of cases; the figure given by various authorities varies from 40 to 80 per cent. Such findings are liable to prompt a scientifically minded clinician to massage these structures in the hope of obtaining material for bacteriological confirmation of his diagnosis. *If tuberculous prostates-vesiculitis is even suspected, on no account should massage be performed for fear of disseminating the disease.*

#### DIFFERENTIAL DIAGNOSIS

*When tuberculosis is suspected, the importance of a family history should be remembered.*

**Malignant Disease of the Epididymis.**—In practically every case of carcinoma of the epididymis recorded, the original diagnosis was one of chronic tuberculous epididymo-orchitis. I have made this erroneous diagnosis; indeed, at the time I did not know that malignant disease of the epididymis existed. There are several examples where a patient with primary carcinoma of the epididymis, with secondary deposits in the lungs, has been sent to a sanatorium diagnosed as tuberculosis. It is therefore wise, when confronted with a hard nodule in the epididymis, to consider the possibility of malignant disease and advise early exploration.

**Tuberculosis in an Anteverted Testis.**—When the epididymis lies in front the diagnosis is comparatively difficult, but if the possibility of testicular anteversion is borne in mind—

which it should be—much of the confusion falls into insignificance

**Staphylococcal epididymo-orchitis** usually develops in the course of a general staphylococcal infection. In contrast to tuberculous infection, the condition usually resolves. If suppuration occurs, a simple incision is all that is required. This brings home the paramount importance of distinguishing staphylococcal epididymitis from tuberculous epididymitis.

**Gonococcal epididymo-orchitis** is seldom chronic and more often the so called chronic cases are in reality recurrent sub acute infections. Gonorrhœal infection is occasionally followed by tuberculous epididymitis. These examples are few and far between, although cases are on record where both *gonococcal* and *tubercle bacilli* have been isolated in excised specimens.

**Spontaneous Thrombosis of the Pampiniform Plexus.**—After the acute symptoms have subsided the thrombosed mass is easily mistaken for tuberculous epididymitis (D McGavin).

**Filarial Infection of the Epididymis** (see p. 127)

#### CLASSIFICATION OF CASES

Having made the diagnosis of chronic tuberculous epididymo orchitis, a very important duty remains. It is to classify the case before us into one of the following groups.

- 1 The disease is apparently confined to the genital system
- 2 There are tuberculous foci in the urinary system notably the kidney
- 3 There are tuberculous foci in other parts of the body, e.g. the lungs

This calls for a thorough examination not only of the testicle and its adnexa, but of the whole patient. It will include an analysis and bacteriological examination of the urine, a physical examination of the thorax, and a routine palpation of the neck for enlarged glands. If there is any doubt as to a renal focus, cystoscopy must be performed.

In relevant cases, an X-ray examination of the chest will be advised. In any case, before commencing treatment and before attempting to give a prognosis, a physician's report on the thorax should always be obtained.

The co-existence of tuberculosis in organs outside the genital tract is admittedly high by all investigators. A pulmonary lesion is by far the commonest of these. Other foci, in order of frequency, are to be found in the kidney, lymphatic glands, or bones and joints.

According to J. D. Barney, as a result of a thorough examination such as outlined above, the following figures were obtained :

In 64 per cent. of cases there was no demonstrable tuberculous lesion outside the genital tract.

In 6 per cent. of cases there was an old lesion which was quiescent.

In 27 per cent. of cases there were demonstrable active foci in the lungs or elsewhere.

#### OTHER QUESTIONS RELATING TO GENITAL TUBERCULOSIS

**Bilateral Tuberculous Epididymo-orchitis.**—Frequently the contra-lateral organ becomes infected. Probably a microscopic lesion is present on the apparently healthy side in many early clinically unilateral cases. This hypothesis is strengthened by the fact that in bilateral cases the second epididymis usually becomes involved within a year. The percentage of cases in which the disease eventually becomes bilateral varies with different statistics. Forty to 55 per cent. appears to be a just estimate. If the opposite testicle escapes infection for five years, it is pretty well out of danger (Keyes).

**Is Genital Tuberculosis Infectious ?**—Spermatozoa never carry tubercle bacilli, nor has it been proved that prostatic fluid harbours the organism. Therefore it is improbable that a female is ever infected by semen from a male with genital tuberculosis.

**Genital Tuberculosis and Sterility.**—Even when the disease is apparently unilateral, the semen is azospermatic in about

85 per cent of cases (Keyes Barney) It is safe to conclude that nearly all sufferers from genital tuberculosis are sterile or will become so This is an important consideration when the question of treatment arises On the other hand these patients are not as a rule impotent but unlike early tuberculosis elsewhere genital tuberculosis tends to lessen sexual activity

**The Relationship of Urinary to Genital Tuberculosis**—When studying the subject it came as a surprise to me to learn that the urinary system is not frequently affected in cases of tuberculous epididymo orchitis For instance there was no involvement of the urinary tract in 80 per cent of the Mayo Clinic cases (V C Hunt) Other carefully compiled statistics support these conclusions It is even more unusual for the tuberculous process to spread from the genital to the urinary system Cases followed over many years show that this occurs in 5 to 7 per cent of instances On the other hand all observers agree on this point—if urinary tuberculosis is diagnosed a suspected lesion in the epididymis is almost without exception tuberculous

**Genital Tuberculosis and Trauma**—It may be argued that a blow on the testicle reduces its resistance and a *locus minoris resistentiæ* results All the world over advantage of this possibility is taken by applicants for compensation If a definite blow can be proved some compensation is likely to be allowed but strains and lifting heavy weights are not now considered ætiological factors in the production of this disease

**Ætiology and Pathology**—The first intrascrotal manifestation of tuberculosis appears fairly regularly in the tail of the epididymis How tubercle bacilli reach this destination has been a disputed question for many years Until it is settled there are bound to be differences of opinion as to the best method of treating genital tuberculosis

There are two distinctly different points of view regarding the origin of genital tuberculosis

1 That as a result of a blood borne infection the disease commences in the tail of the epididymis and later

spreads to other parts of the genital system (the ascending theory).

2. That the vesicles or prostate are the starting-point of the genital lesion (the descending theory).

Both schools have strong adherents, and at the present time, so far as can be judged, they are about equally divided.

**Details of the Controversy.**—The *second* school was founded by Guyon, the father of modern urology. It is a theory which bristles with common sense. The infection is believed to follow a path well-known in Neisserian and other infections—namely from the vesicle to the epididymis. H. H. Young is a prominent member of this school, while Kenneth Walker, as a result of experimental work, supports it whole-heartedly.

The *first* school makes a strong case by propounding the following conundrums :

(a) There are scores of cases where, at necropsy, an epididymal lesion has been found, but the prostate and vesicles have been shown to be quite healthy. Furthermore, both clinically and at post-mortem, cases of tuberculous prostatitis without involvement of the epididymis are almost unknown.

(b) Quite often prostatic and vesicular tuberculous lesions heal after removal of the epididymal lesion. Presumably, if the disease commenced in the vesicle, removal of the epididymal extension would have but little effect on the older lesion.

Extension to the body of the testicle rarely occurs, even after many years (fig. 96). Professor Marion, after an immense experience with this condition, states that the body of the testis remains uninvolved in 80 per cent. of cases. Very occasionally the body of the testis is involved without the epididymis.

## TREATMENT

Great differences of opinion exist and changes in fashion are rather frequent. The pendulum swings from ultra-conservatism to ultra-radicalism, and back again. To some degree this is due to the lack of precise knowledge of the starting-point of genital tuberculosis. When I consult a book for a lead on treatment, I expect to find what the author thinks is best ; it is just this that prompts me to follow the dictates of my belief rather than to set out the views of opposing schools, even though their members are great authorities.

**General Treatment.**—No one would attempt to deny the necessity for general treatment in any manifestation of tuberculosis ; on the other hand, to banish a patient to a

sanatorium for two years is naturally to be avoided if he can be fitted for the battle of life by quicker means. On the whole patients with genital tuberculosis treated on purely conservative lines in so far as statistics are available do not do particularly well because the conditions ideal and the

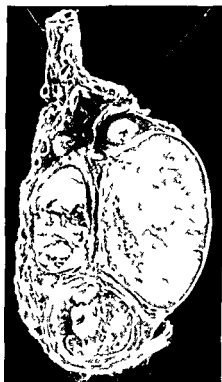


FIG 96 —Extension to the body of the testis rarely occurs even in long standing cases of tuberculosis of the epididymis

regime ever so strict. Therefore it is advisable even if the patient has to undergo sanatorium treatment to recommend surgical measures for the genital lesion.

Until the patient has been classified (see p 114) no treatment should be attempted. If there is an active pulmonary lesion sanatorium treatment is essential because of the major lesion. If there is an operable kidney lesion this must be attended to first. In other cases general treatment will be prescribed as best can be carried out by the individual patient.

**Ultra-violet light** is definitely beneficial.

The treatment should be begun gradually depending on the skin reaction. Short exposures of seven to eight minutes at 12 inches to 15 inches have worked well.

**Tuberculin** —Opinions differ as to the value of tuberculin. Some observers are quite enthusiastic. A post operative course certainly does no harm. The dosage recommended



by C. Nitch is as follows : 12 injections of Koch's T.R. at weekly intervals, commencing with a dose of  $\frac{1}{10000}$  mg. and increasing each week by  $\frac{1}{10000}$  mg. The maximum dose of  $\frac{1}{1000}$  mg. is given during the tenth, eleventh, or twelfth weeks.

### OPERATIVE TREATMENT

All operative procedures for genital tuberculosis, with the exception of tying the vas, carry a small, but definite, mortality, perhaps 5 per cent. It appears that during operative manipulations bacilli are easily dislodged from the sperm-conducting mechanism into the veins. At any rate, many statistics from first-class clinics show that disseminated tuberculosis occasionally follows operation. With proper technique, gentle manipulation, and the electro-surgical knife, this disquieting complication should be reduced to vanishing point.

**Orchidectomy.**—Unless the body of the testis is involved—which, as a rule, is not the case—orchidectomy is, in my opinion, unjustifiable, for in at least 50 per cent. of cases the disease is likely to appear on the contralateral side. The loss of both epididymes is preferable to the loss of one testis.

**Epididymectomy.**—If properly carried out, epididymectomy is an excellent procedure. The operation has received very little attention in Britain; indeed, in a long apprenticeship in various British clinics, I never saw it performed. Because of the high incidence of involvement of the remaining epididymis, even in apparently unilateral cases, I should urge that the operation be performed on both sides. The patient is quite unaffected by ablation of the epididymis, and, as we have seen, in nearly all cases he was sterile before treatment was commenced. If the patient preferred to keep the apparently unaffected epididymis, in order to help to prevent the dissemination of the disease I suggest the minor procedure of tying and dividing the vas on that side. This is nearly always acceded to.

**After-treatment.**—Even in a subject with no demonstrable extra-genital focus a reasonably long convalescence at the seaside or in rural districts should be insisted upon. For a year afterwards he should receive regular ultra-violet

light, and tuberculin if the clinician thinks it beneficial. At least once a month a rectal examination with particular reference to the seminal vesicles must be made. In a proportion of cases, after epididymectomy combined with suitable general treatment an involved vesicle tends to improve. If, after six months a previously diseased vesicle appears to be stationary or alternatively, is becoming more diseased, the advisability of vesiculectomy by the inguinal route should be considered seriously. In relevant cases the patient should be warned of this possibility before the epididymectomy is undertaken, and before the vesiculectomy a further overhaul by the physician is advised.

**The Technique of Epididymectomy.**—If a sinus or sinuses are present they should be seared with a diathermy point after the scrotum has been sterilised. The scrotum is then seized, as shown in fig 97 and gentle pressure is made above the testicle. An elliptical incision is made in the skin about the sinus and the tissues divided down to the tunica vaginalis. By these means the testicle and epididymis are extruded from the scrotum.



FIG 97

The same method is used if there is no sinus only a vertical incision is made over the epididymis. Scrotal extrusion avoids the trauma which is almost inevitable if an inguinal incision is used. As the testis is extruded from the scrotum it is received into a saline soaked abdominal pad. The tunica vaginalis is opened. The epididymis is then prised from the body of the testis with the handle of a scalpel until the connecting link between the two structures is clearly visible. Using the diathermy knife, the epididymis is severed from the body of the testis (fig. 98), leaving the epididymis attached to the



FIG 98

vas and the testicle to the other constituents of the cord (fig. 99). The epididymis and the body of the testis are each wrapped in moist gauze (fig. 100). A

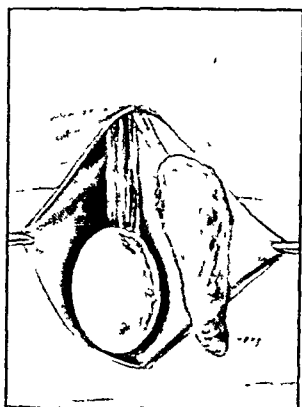


FIG. 99.

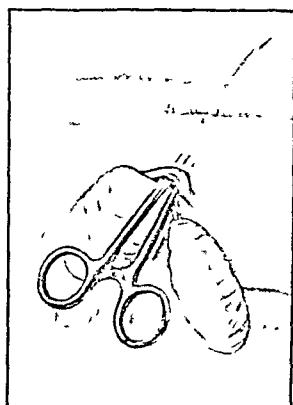


FIG. 100

hæmostat is passed into the scrotal wound, and its point is made to protrude beneath the skin over the external

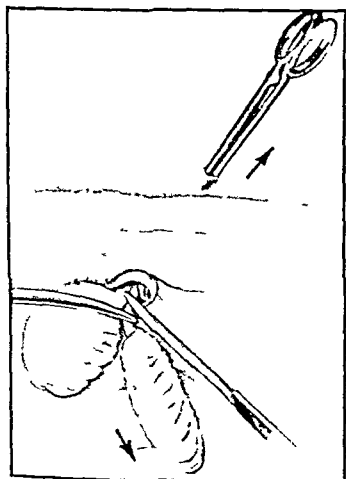


FIG. 101.

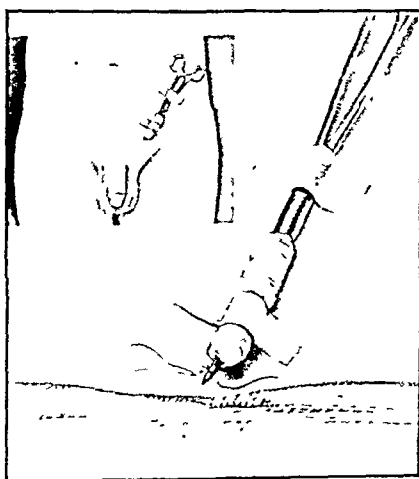


FIG. 102.

abdominal ring (fig. 100). A small nick is made over the tip of the hæmostat, and another hæmostat is pushed along the same path. The latter is used to clamp the vas near the epididymis (fig. 101). With the diathermy knife the vas is

severed distal to the clamp, freeing the epididymis, which is cast aside. The clamp and the vas are then drawn upwards and this brings the vas on to the groin. The clamp is not removed nor is the vas ligated. A single stitch is passed through the nuck in the skin. This stitch is tied, not tightly, about the vas. The clamp with the vas attached to it is wrapped in gauze and strapped to the abdomen (fig 102). The testicle is replaced in the scrotum and the scrotal wound is closed by interrupted stitches. The scrotum is supported on a bridge of adhesive plaster placed across the thighs. In about seven or eight days the vas separates at the level of the skin, just like an umbilical cord.

The principles of the above operation are those of A. B. Cecil. He does not use the diathermy knife, which I think is a distinct improvement, but his well thought out principles avoid trauma, prevent infection, and without doubt bring epididymectomy to a fine art.

In addition to epididymectomy, J. H. Cunningham recommends injecting 20 per cent. carbolic acid down the vas with a view to sterilising the corresponding seminal vesicle. This appears to be a sound augmentation to the above technique.

**Vesiculectomy by the Inguinal Route.**—The bladder must be absolutely empty, and in order to ensure this a catheter should be passed when the patient is on the operating table. An ample inguinal incision is made, and the stump of the divided vas is found and secured. The inguinal canal is opened by dividing the external oblique. The conjoined tendon is retracted upwards and inwards, and the deep epigastric vessels are ligatured and divided. If there is insufficient room, some of the fibres of the conjoined tendon can be severed. With the aid of a good light, the vas is followed into the depths of the wound the peritoneum being lifted off it by gauze dissection. The patient is now placed in Trendelenburg's position and it will not be long before the nodular seminal vesicle is reached. This is dissected out to some extent by the finger, but a touch or two of the scalpel is usually necessary posteriorly. There is very little bleed

ing, and most of it can be controlled by gauze pressure. The vesicle must be removed absolutely intact. The wound is drained with a strip of corrugated rubber and the abdominal wall repaired.

### PROGNOSIS

The prognosis of genital tuberculosis is sometimes stated to be extremely poor. Probably the eventual outlook is poor in cases where there is a major extra-genital lesion, and it is these which cloud the prognostic picture of massed statistics. Treated on the lines outlined above, taking all classes, the following figures are helpful. Of 175 patients treated at the Mayo Clinic 60 per cent. were known to be alive and well for more than five years (Bumpus and Thompson), and of sixty-two patients at Legueu's clinic 43·5 per cent. were cured or very greatly improved after being followed for two to eight years (N. de Langre). R. O. Lees and K. Bowes, after a statistical enquiry into the subject, came to the conclusion that removal of an infected seminal vesicle seemed to decrease the remote mortality.

The three most frequent causes of death are tuberculous meningitis, pulmonary tuberculosis, and miliary tuberculosis (Kretschmer).

### RADICAL OPERATIONS

**Young's Method.**—H. H. Young advocates and has practised successfully a radical operation performed through a perineal incision. The epididymis, vas, seminal vesicle, and common ejaculatory ducts are removed *en bloc*. The success which this authority has obtained must, in a very large measure, be due to the practice in perineal prostatectomy which he and his pupils have acquired. To those who have not had a great experience in this method of performing prostatectomy, the undermentioned operation is more likely to make an appeal.

**Loughnane's Epididymo-vaso-vesiculectomy.**—Epididymectomy is carried out, together with removal of the vas and seminal vesicle, by the inguinal route at one sitting.

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## CHAPTER XV

### FILARIAL INFECTIONS OF THE MALE GENITAL TRACT

THE filarial worm in its mature stage is an inhabitant of the lymphatic system of man. It is responsible for a number of lesions of the male genital tract.

**Lymphatic varicocele** is the earliest, and sometimes the only, manifestation of filarial infection of the male genital tract. Usually there are no symptoms, and the early diagnosis is made only in a routine examination of the patient. The condition resembles a varicocele, but unlike a varicocele, it does not disappear when the patient lies down.

Treatment by local injection of sodium morrhuate solution is said to be satisfactory (Ray).

**Hydrocele.**—Hydrocele is particularly common in districts where filarial infection is rife. Observers working in these districts have found that in upwards of 10 per cent. of cases the hydrocele fluid contains micro-filariae.

**Elephantiasis of the Scrotum.**—Although

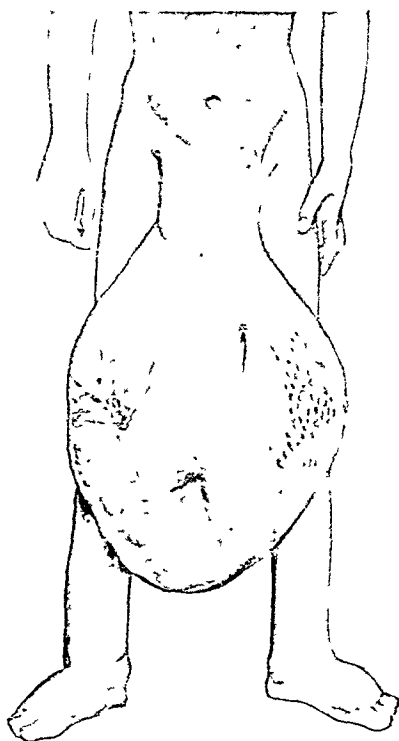
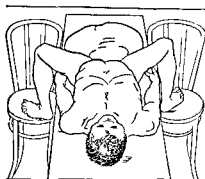


FIG. 103.—Filarial elephantiasis of the scrotum. The scars of previous attacks of acute inflammation can be seen. (After Sir Frank Connor.)

associated with filarial infection tropical elephantiasis (fig 103) is not necessarily caused by the parasite Lymphatic obstruction probably plays the major role but there is an erysipeloid streptococcal infection superadded which intensifies the course of the disease

Treatment is surgical removal of the mass A most important consideration in removing enormous scrotal tumours is the position of the patient upon the operating table He should lie with his legs hanging over the sides of the table and his feet supported upon chairs (fig 104) This



gives excellent exposure allows the mass to be rolled and at the same time obviates handling or lifting the scrotum The penis and testes are dissected out through an incision over the pubes and the operation is usually completed with out cutting into the elephantoid tissue After the mass has been removed the testes are accommodated one behind the other

FIG 104 —Position of the patient for the removal of an elephantiasis of the scrotum Note the feet supported on chairs

in the perineum and the penis is placed in a tunnel under the skin of the abdomen the glans being brought out through a small incision At a second operation under local anaesthesia the penis is freed

**Lymph scrotum** is differentiated from scrotal elephantiasis by its reddish brown colour and the presence of vesicles either discharging or encrusted The discharge of chylous fluid may amount to several ounces in the twenty four hours The discharge continues for several days

Treatment is unsatisfactory With rest in bed and local applications the discharge usually ceases for a time

**Filariasis of the Spermatic Cord**—The worm lodges in the anterior part of the spermatic cord Periodically owing



to cyclical parturition of the female, an acute hydrocele appears. The hydrocele fluid is loaded with micro-filariæ. The scrotum becomes shiny, and there is discomfort or pain referred to the cord. The process lasts two or three days, when restitution occurs. With each recurring attack, the hydrocele increases in size and eventually becomes chronic.

The treatment recommended by Ferrer is to *excise the anterior group of veins of the cord*. In so doing the lymphatics harbouring the parasite will be removed. In addition, the hydrocele should receive appropriate operative treatment. It is quite unnecessary to perform orchidectomy, as has been recommended and practised in the past.

Filariasis of the spermatic cord is liable to be complicated by endemic funiculitis (see p. 87). The relationship of the two conditions is very definite, but how and why it occurs has not yet been worked out fully. A hæmolytic streptococcus can be isolated from the tissues about the cord in these cases (De and Chatterji).

**Acute Filarial Epididymo-orchitis.**—The globus major is attacked particularly. Like the above, the attacks are periodical, but in this instance constitutional symptoms are severe. There is colic, nausea, and pain, radiating from the scrotum to the inguinal canal and the lower abdomen. The temperature often rises to 103. During the acute stage of the attack micro-filariæ will be found in the circulating blood. The epididymis is exquisitely tender. The scrotum is only slightly œdematous, mainly on its posterior aspect, and a hydrocele is unusual. The acute stage usually resolves in a few days, only to be followed by further attacks.

**Chronic Filarial Epididymo-orchitis.**—As a result of the above recurrent attacks, the globus major becomes larger and larger until it can be felt as a marble. Sometimes necrosis of the epididymis occurs, which results in a sinus discharging posteriorly and an inevitable secondary infection. At others the epididymis becomes fibrotic and contains the calcified worm. The similarity between this condition and tuberculous epididymitis is striking. The two conditions resemble one another in every particular and,

what is even more important, chronic filarial epididymitis responds splendidly to the operation of epididymectomy carried out on the lines advocated for tuberculosis

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## CHAPTER XVI

### SYPHILIS OF THE TESTICLES

THAT in established syphilis the *spirochæta pallida* attacks the testicle in preference to any other tissue, except perhaps the heart and aorta, is not generally appreciated. Proof of this assertion lies in carefully conducted post-mortem examinations. Professor Turnbull, whose experience of morbid anatomy is unrivalled, considers fibrosis of the body of the testis one of the most reliable post-mortem evidences of syphilis (fig. 105). Clinically syphilitic affections of the testicle are rare; the eminent syphilologist, Fournier, who kept most accurate records of his cases, found the testicles to be affected in only 5 per cent. of his cases. By co-relating these two view-points we arrive at an important conclusion—most syphilitic lesions of the testicle are latent.

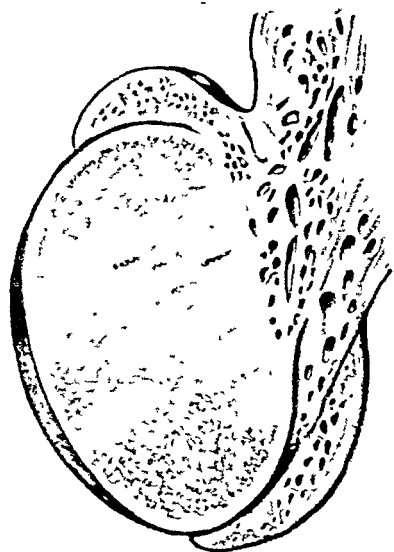


FIG. 105.—Fibrosis of the parenchyma of the testicle. From a syphilitic post-mortem subject.

**Latent syphilitic orchitis** towers above its sister lesions in importance for these reasons: It occurs frequently and is so unobtrusive, yet the semen from a man suffering from the condition is often teeming with spirochætes. Finger and

Landsteiner were able to successfully inoculate monkeys with syphilis by means of this semen. Kertesz found that in twenty men with latent syphilis—some with positive and some with negative reactions—none of whom had had symptoms for years, all had infected their wives. This raises the question whether vaso ligature should be recommended in cases where the secondary stage of syphilis has been reached before treatment is commenced.

**Congenital Syphilitic Orchitis.**—Should a congenital syphilitic boy be fortunate enough—if, indeed, he can ever be called fortunate—to reach puberty, certain ills are hable to befall him. He tends to become lame, deaf, blind, and impotent. Lame because of Clutton's joints, deaf because of otosclerosis, blind because of interstitial keratitis and impotent because of diffuse fibrosis and atrophy of the testicle. The reason for the testicular changes is that at some previous time there has been an attack of bilateral interstitial orchitis. Typically this occurs between the third and tenth months of infant life, and it gives rise to what is sometimes known as the "pigeon egg testicles of syphilitic infants." Less commonly, the attack is delayed for some months or years. The observers who have seen most cases agree that secondary hydrocele is rare in this condition. It is interesting and important to note that the testicles in congenital syphilis are swarming with spirochaetes, even when no histological changes can be recognised.

**Acquired Syphilitic Epididymitis.**—An infection of the epididymis in the secondary stage of syphilis is described by many authorities. The condition is said to be bilateral in one third of cases. All are agreed that syphilitic epididymitis is extremely rare—it is so rare that it has been hinted that possibly a concomitant gonococcal infection may be responsible for the trouble.

**Tertiary interstitial orchitis** is frequently bilateral, although both organs are not necessarily affected at the same time. The condition rarely appears before the second and usually during the third and fourth years after the primary infection. There is a painless, smooth enlargement of the body of the testis. A small secondary hydrocele is a regular accompaniment in the early stages, but curiously this becomes absorbed

as the condition progresses. The testicle loses its ovoid shape and becomes globular. When the condition is fully established, the testicle is rounded, densely hard, completely insensitive to pressure, and freely movable within its scrotal coverings. What better name could be given to it than the "billiard-ball testicle"? The condition responds to anti-syphilitic treatment.

**Gumma of the testis** is a distinctly late manifestation of syphilis. In four cases out of five the lesion is unilateral. It rarely appears until at least ten years after the primary infection. Sir D'Arcy Power describes the case of a man of 80; more than sixty years had elapsed since he acquired the infection. Gumma of the testis (fig. 106) in its early stages gives rise to signs and symptoms somewhat like chronic interstitial orchitis—but also much the same as those of neoplasm of the testis. Considerably diminished testicular sensation favours the diagnosis of testicular syphilis; a positive Wassermann reaction is likewise suggestive, but one must not put implicit trust in this laboratory test; of course, it is possible for a new growth to occur in a patient with a syphilitic taint. If there is the slightest doubt, it is surely better to remove a disorganised syphilitic testicle than to delay in the removal of a malignant growth (Dew). A gumma of the testis, in process of time, involves the scrotal coverings, and it is anteriorly where the adherence occurs. Later, ulceration of the overlying skin results (fig. 107).

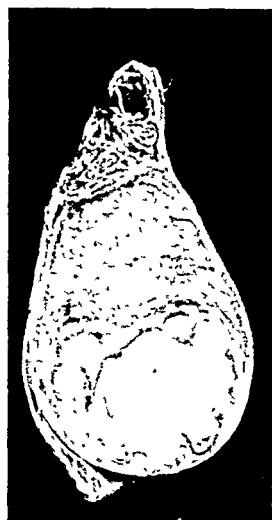


FIG. 106.—Gumma of the testis.

So far as my experience has gone, gummata of the testis appear to respond exceptionally well to anti-syphilitic treatment. For instance, in the case illustrated, under the influence of novarsenobensol the lesion disappeared like dew before the sun. However, there are some clinicians

who advise orchidectomy in these cases the argument being that testicular gummata are inclined to be rebellious to treatment and even if they are not atrophy of the testis will ensue. The aftermath of a gumma of the testis is not necessarily atrophy. T. R. Hagner cites the case of a man



FIG. 107.—Gumma of the testis commencing to ulcerate. The condition responded admirably to anti-syphilitic treatment.

with bilateral gummata of his testicles the size of a foetal head who begat seven children after receiving specific treatment.

**Fungus Testis** (*syn* Hernia Testis) —As a medical student the very first case I ever saw was a fungus testis. What made such an impression on me was that the man had no pain. The testis was extruded on to the surface through an ulcerating mass in the front of the scrotum. Owing to better treatment of syphilis the condition is now extremely rare. It is usually but not necessarily a late stage of a gumma. Neglected malignant disease is said to sometimes give the same clinical picture.

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## CHAPTER XVII

### NEOPLASMS OF THE TESTICLE

*For practical purposes all tumours of the testis are malignant.*

*Uncertainty as to the nature of non-translucent testicular swellings has resulted in loss of valuable time before the institution of the proper treatment of malignant disease.*

**Early Diagnosis.**—In its early stages malignant disease of the testicle is most elusive, and it is the exception for the clinician to recognise it—even experts fail. Realising this, Maurice Chevasu, who has examined more than 100 cases, advises that if there is the slightest enlargement of the body of the testis which cannot be accounted for clearly, the organ should be displayed to the light of day. One might go further, and include a suspiciously hard nodule in the epididymis (see p. 113).

Using local anæsthesia, the skin over the inguinal canal is infiltrated and likewise the cord. This permits the testis to be delivered on to the surface without pain.

After the testis has been bared of its coverings, fully 90 per cent. of early malignant disease can be recognised at once. The body of the testis is enlarged and a hardness can be detected on palpation. Instead of being dead-white (fig. 108), the tunica albuginea is somewhat vascular in one place. If there is still any doubt, orchidectomy should be performed.

Another aid to earlier diagnosis is the hormone test. The majority of tumours of the testis are embryonal, and urine from these patients, when injected into immature female rodents, produces gross enlargement of the uterine horns and/or ripening of the ovarian follicles (fig. 109). The presence of such a hormone in the urine is strong, but not absolutely reliable, confirmatory evidence of testicular malignancy. Similarly a negative result, although nearly

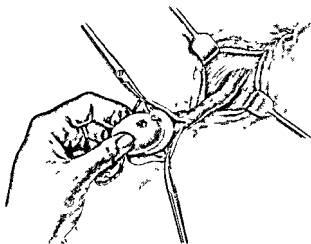


FIG. 108 — A leash of blood vessels at one point in the otherwise dead white tunica albuginea is proof of an early neoplasm of the testicle. An induration in this area makes a diagnosis almost undeniable.

always accurate does not rule out the possibility of a testicular neoplasm.



A

B

FIG. 109 — The hormone test for malignant testis. A. Uterus, tubes and ovaries of an immature female rat. B, after five subcutaneous injections of urine from a subject suffering from testicular teratoma. Rat killed 100 hours after first injection. (After Hinman and Powell.)

It is to the hormone test and to displaying suspected cases to the light of day that we may look for earlier diagnosis, and consequently earlier treatment and a more hopeful attitude towards these cases.

#### CLINICAL FEATURES

It is true that tumours of the testicle are rare, they constitute but 58 per cent of all malignant tumours in men. However, in order to correct an impression that they are too infrequent to merit close attention, it should



be mentioned that in nine years 155 cases were seen at the Mayo Clinic.

**Age Incidence.**—As will be seen from fig. 110 no age is exempt, but the disease is immeasurably more common during the years of greatest sexual activity.

**Symptoms.**—Pain is usually absent. There is an enlargement of the testicle, accompanied by some sense of weight. Only too often the patient has “taken no notice of it.”

A teratoma, by reason of its more rapid growth, is more likely to attract the patient's attention than the other class of tumour, a seminoma. Indeed, investigation shows that the average time in which patients with a teratoma report is about six months, whereas those with a seminoma usually delay over a year.

In not a few instances attention is drawn to the testicle by a knock or a blow, which is erroneously blamed for the enlargement. From time to time the first symptoms are produced by metastases (p. 137).

**Physical Signs.**—Malignant disease of the testicle nearly always begins in the body of the testis. The growth preserves the shape of the normal organ until late. To the palpating fingers it feels hard and tolerably smooth, although in many teratomata areas of cystic degeneration can be made out. The epididymis is normal, but soon becomes indistinguishable from the mass. In reasonably early cases the swelling can be moved freely within the scrotum and can usually be squeezed gently without pain.

**Malignancy and maldescent** have been considered already (p. 13). Undoubtedly the testis in the inguinal canal is more prone to neoplastic formations, due presumably to its increased liability to trauma. The early recognition of malignancy in a cryptorchid is extremely difficult.

**Hypertrophy of the Breasts.**—The male breasts may enlarge under the influence of abnormal gonadal internal secretions from a teratoma of the testis. In one case under

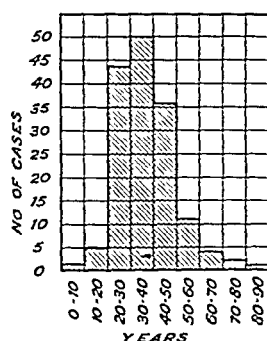


FIG. 110.—Age incidence of neoplasms of the testis.

my observation this hypertrophy was pronounced. In a man aged 24 with a malignant testis the breasts became enlarged and colostrum-like fluid could be expressed (L. Sas).

### DIFFERENTIAL DIAGNOSIS

In time past, as at present, the difficulties of distinguishing an old clotted hæmatocele, malignant testis, and a gumma were fully appreciated. A valiant attempt was made to differentiate these by means of physical signs, but with only limited success.

**From Gumma.**—The sign of loss of testicular sensation is extremely valuable, but only in early cases. In syphilis testicular sensation is lost early, while in malignant disease it is retained until the seminiferous tubules have been supplanted by the neoplastic formation.

**Weighing the Testis**—A malignant testicle often imparts a sensation of weight, but this sign is really utterly unreliable and without any scientific foundation.

The Wassermann reaction is, of course, highly suggestive, but it should be remembered that it is possible for malignant disease to appear in a syphilitic patient. If any doubt remains it is better to remove a disorganised syphilitic testicle than to delay in the removal of a malignant growth (Dew).

**From an old Clotted Hæmatocele.**—There is no clinical method of differentiating this condition with certainty from malignant disease of the testicle.

**Secondary Hydrocele.**—It is stated repeatedly that malignant disease of the testicle is often accompanied by a secondary hydrocele containing blood stained fluid. How this misconception arose can only be attributed to the confusion that exists between hæmatoceles and tumours of the testis. There is no evidence that even advanced cases of malignant disease are accompanied by a blood stained effusion into the tunica vaginalis. Early in the course of malignant disease there is a secondary hydrocele in approximately 15 per cent of cases, but as the condition advances the hydrocele appears to become absorbed, and it is quite rare for an established case to be accompanied by an appreciable collection of fluid.

**From Tuberculosis.**—While in malignant disease of the testis the primary growth is usually confined to the body of

the testis, it can also commence in the epididymis. In practically every case of malignant disease of the epididymis which has been reported, the original diagnosis was one of tuberculosis. With this exception, there should be little difficulty in differentiating the two conditions.

### METASTASES

As is well known, the main path by which secondary growths spread is via the lymphatics accompanying the spermatic artery to the retroperitoneal glands above the level of the umbilicus (see p. 57). Secondary growths in this situation sometimes attain an immense size and obstruct the ureters or the intestine. From here lymphatic drainage is towards the mediastinum and the supra-clavicular fossa (fig. 111). I have seen a secondary mass in the neck in two cases of advanced malignant testis. Involvement of the inguinal nodes is rare.

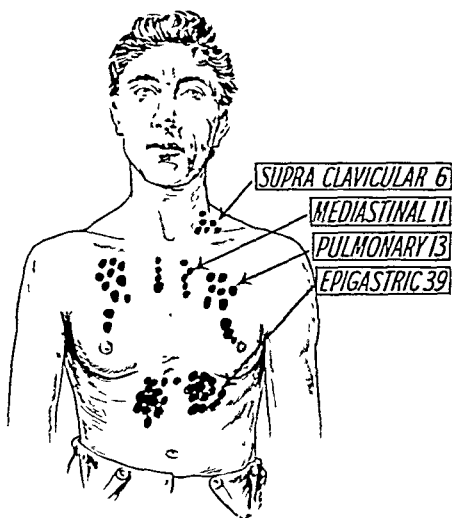


FIG. 111.—Distribution of glandular metastases in malignant disease of the testis. (R. S. Ferguson's statistics.)

### PATHOLOGY

Following the classical work of H. Dew. in round figures testicular tumours are distributed as follows :

Teratoma	.	.	.	.	.	50 per cent.
Seminoma (carcinoma)	.	.	.	.	.	49 „ „
Sarcoma	.	.	.	.	.	1 „ „

**Seminoma** was the term coined by Chevassu, who described this now well-known pathological entity. Seminomata appear to arise from the adult cells of the seminiferous

tubules, and therefore, for practical purposes, can be looked upon as carcinomata. When examined by the naked eye a seminoma is a homogeneous cream coloured tumour (fig 112), sometimes it is marked off by fibrous septa into fairly distinct

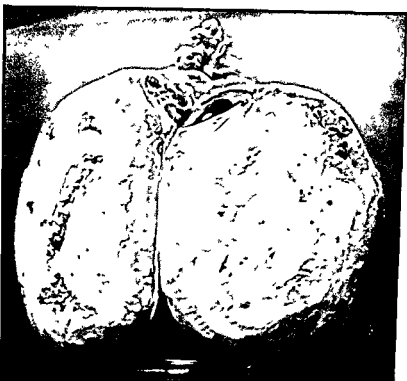


FIG 112—Seminoma of the testis is a homogeneous cream coloured tumour

lobules. Occasionally softening from cystic degeneration occurs.

**Teratoma.**—Like teratomata elsewhere these tumours are derived from all three primary germinal layers, viz epiblast, hypoblast, and mesoblast. Sometimes, however, one of the layers—most usually epiblast—is inconspicuous or absent. Teratomata vary enormously in their constituency and also in their malignancy. Usually they are exceedingly malignant, and they tend to occur at an earlier age than the

seminoma. Teratomata of the testis are often distinctly cystic (fig. 113) and cartilage of the hyalin variety is a prominent constituent.

**Chorioneplithelioma** is a great rarity, and is to be regarded as an interesting variety of teratoma. It is similar in structure to the chorionic epithelioma of the female generative organs. One hundred and nine cases have been reported (Handfield-Jones).

**Sarcoma.**—In the light of modern pathology sarcoma of the testis is exceedingly uncommon. When it occurs it arises from the fibrous stroma of the testis. Sarcoma of the spermatic cord and of the coverings of the testis are not included here, but receive brief mention below.

**Dermoid cysts** are most unusual in man, but a testicular dermoid is common in the horse, and is in that animal frequently associated with cryptorchidism (Hobday). The contents of the cyst may display curiosities which characterise dermoid cysts elsewhere.

**Innocent tumours of the testis** are as rare as dermoids, and it is best to look upon them as a variety of teratoma where one element is present exclusively. It is advisable to make certain that a supposed innocent tumour of the testis is not in reality a tumour of the spermatic cord.

**Tumours of the Spermatic Cord.**—The commonest tumour is a lipoma. Fibromyomata, sarcomata, and fibrosarcomata make up a miscellaneous collection of rarities which are met with from time to time.

**Tumours of the testicular tunics** are again excessively rare. Fibromata and sarcomata are the usual neoplasms in this situation.

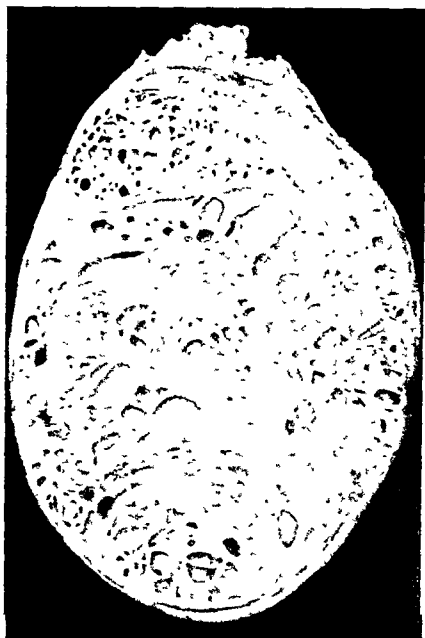


FIG. 113.—Teratoma of the testis is a heterogeneous mass often interspersed with cysts and cartilaginous areas. (A. E. Hertzler.)

### TUMOURS OF THE EPIDIDYMIS

Reference has been made already (pp. 113 and 133) to malignant disease of the epididymis and how it is usually confused with tuberculosis. I have stressed this point because

I have committed this error and would urge that if a suspiciously hard nodule is found in the epididymis epididymectomy should be performed and the specimen submitted to histological scrutiny without delay

### TREATMENT OF MALIGNANT TESTES

Simple orchidectomy is occasionally followed by a lasting cure providing the case is a very early one and/or the tumour is one of relatively low malignancy. Such examples are so unusual that orchidectomy *per se* is now rightly looked upon as quite inadequate.

Orchidectomy combined with deep X-ray therapy has, in some instances, achieved remarkable results. In other cases the deep X rays have no influence on the course of the disease. The reason for this is that not all testicular tumours are radio sensitive. In the past this discrepancy, which is not yet sufficiently appreciated, has been the underlying cause of much acute disagreement. One can quite understand that if "A" happened to have a small series of cases which had responded to X rays he would, with deep conviction, condemn "B," who suggested that X ray treatment was not a panacea and that a better method of treating these cases was to perform a wide surgical dissection of the lymphatic field. It was perhaps unfortunate that "A" would sometimes allow his conviction to prejudice him into believing that the radical operation was an immensely dangerous procedure even though he had never seen it performed.

A step forward has been made. It is now possible to accurately foretell if deep X rays will influence the course of the disease.

**The Hormonic Test in Relationship to X-ray Treatment.**—Presuming that in the case under consideration the hormone test is positive, in a few weeks' time, after a course of deep X-rays, another hormone test is performed. If hormone is now absent from the patient's urine, or if the quantity (it is possible for the skilled pathologist to make a quantitative estimation) has reduced, this is proof indeed that the

tumour is radio-sensitive. Such findings indicate that the patient will benefit by X-ray therapy. Another extremely valuable application of the test is that the reappearance of a positive reaction foretells that secondary growths are forming long before they are manifest clinically.

Whatever stage of the disease has been reached the possibilities of controlling it by deep X-ray therapy should be exploited ; no case should be abandoned as hopeless without a full investigation. In this connection an interesting and important clinical observation was made by A. L. Keyes before the hormone test was discovered. It is this—the very cases which are quite incurable by surgery because of their malignancy, i.e. those with massive secondary deposits, are sometimes the ones most amenable to X-ray therapy.

#### RADICAL OPERATION

It is surprising that the idea of removing the lymphatic field, together with the malignant testicle, has not made a wider appeal. In the case of malignant disease of the breast simple mastectomy is now never contemplated : the suggestion of removal of the breast and leaving the lymphatic glands would cause a shudder ! Even when a carcinoma of the mouth is treated by radium, the cervical lymphatic glands are usually dissected. Why then should an exception be made in the case of the regional lymphatic field of the testicle ? Probably it is a belief that extirpation of the retroperitoneal glands, together with the fat and fascia, is an immensely heroic undertaking. In practice this is not so. That removal of the testicular lymphatic field is not particularly dangerous is emphasised by the following statistics. More than 100 cases of radical operation have been performed by American surgeons with a single operative death, and that from pneumonia ten days after the operation (F. Hinman). Nineteen consecutive operations were carried out at the London Hospital without mortality.

If there are palpable glandular metastases radical operation is impossible ; the only hope lies in deep X-ray therapy. Even when there are no palpable glands radical operation

may be incapable of being completed because of metastases adherent to the vena cava

In one such case I implanted radium needles into the adherent glands, but a year later the patient returned with recurrences in the thorax and neck

### TECHNIQUE

**Position of the Patient.**—The patient lies on his back with a substantial sandbag under the affected side. This allows access to the neighbourhood of the twelfth rib as well as to the abdomen



FIG 114.—Patient after radical operation for removal of a malignant right testicle. The patient was alive and well eighteen months later. Deep X ray therapy was employed in addition. To show the extent of the incision.

**Orchidectomy.**—Through an inguinal incision the cord is isolated and clamped. It is clamped early in the procedure in order to prevent dissemination by the blood stream when the testicle is manipulated to deliver it on to the surface. The latter having been accomplished the cord is divided between clamps with a cautery. Every endeavour is made to prevent spilling carcinoma cells. If any carcinomatous tissue has been exposed during the orchidectomy, the gloves should be changed before proceeding with the remainder of the operation. Swabbing

the wound with 60 per cent alcohol is valuable as a means of killing any cancer cells which may have been liberated.

**Extending the Incision.**—For radical removal of the retro peritoneal glands the incision is a very long one extending from the twelfth rib to the external abdominal ring (fig 114). The aponeurosis of the external oblique is divided and the



muscle fibres split up as far as possible. In the upper part of the wound the muscle fibres are cut across in the same direction as the skin incision. The fibres of the internal oblique and transversalis muscles are divided in the line of the incision. The peritoneum will now have been reached, and can be stripped off readily from the iliac fossa and the posterior abdominal wall. This separation is done most carefully, and if a tear in the peritoneum occurs it must be sutured at once.

**Block Dissection of the Ilio-Lumbar Glands.**—The peri-

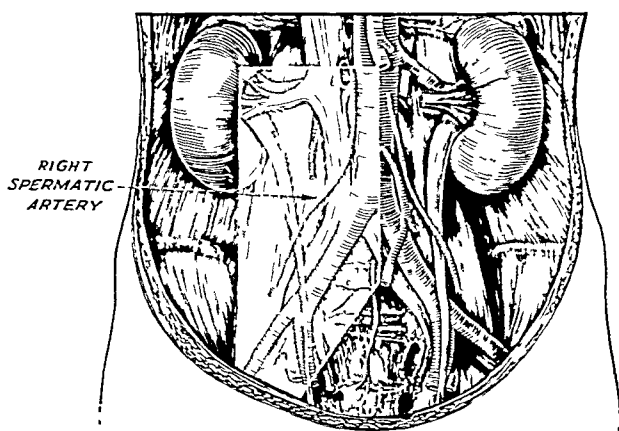


FIG 115 —Lymphatic field draining the right testicle.

toneum is stripped back to beyond the great abdominal blood-vessels. The vas deferens is followed into the pelvis and divided with a cautery near the seminal vesicle. The peritoneum is now held out of the way by the assistant, who protects it with a saline-soaked abdominal pad. The fascia over the iliacus is dissected medially, and with the taut spermatic vessels acting as a guide, the dissection proceeds upwards. The whole fascia, from the outer border of the psoas to across the middle line, is dissected up in one piece (figs 115 and 116). While this is being done the ureter is held aside. The spermatic artery is ligatured close to its origin from the aorta, and the spermatic vein likewise as its

termination The dissection is carried right up to the renal vessels, and the aim is to remove fat, fascia, and lymphatics in one sheet (fig 117) This dissection is most practicable on the right side, on the left side it is more difficult The difficulty is the inferior mesenteric artery Around this artery the peritoneum is varyingly adherent making the dissection above this point distinctly difficult It is for this reason that F Hinman now inclines to the view that the dissection of the retroperitoneal glands is best

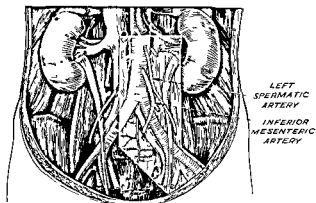


FIG 116 —Lymphatic field draining the left testicle The inferior mesenteric artery is a bar to thorough dissection on the side

performed from the right side even if the malignant testis is on the left

In animal experiments the inferior mesenteric artery has been tied close to the aorta without ill effects If this could be done in man, the dissection on the left side would be more practicable As it is, one should respect this artery even at the risk of leaving behind potentially malignant tissue

### PROGNOSIS

In the past the outlook in these cases has been most depressing With earlier diagnosis, the hormone test, deep X rays, and the radical operation, the results of treatment should show considerable improvement That the radical



FIG. 117.—The complete operation for malignant testicle. Block dissection of the ilio-lumbar glands. (After F. Hinman.)

operation, is worth while seems to be proved by the following summary of Hinman's investigations.

	Cases.	Dead.	Alive after 5 years.
Radical operation . . . . .	80	29	17
Orchidectomy with or without radiation . . . . .	258	118	17

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## CHAPTER XVIII

### FUNCTIONALLY IMPERFECT TESTES

ADULT testicles vary considerably in size within normal limits. Small, obviously imperfect but descended testes may be due to under-development or to subsequent atrophy.

**Under-developed testicles** are often associated with Fröhlich's syndrome and other endocrine disturbances. More rarely the testicles entirely fail to mature at puberty, there being no apparent cause for this failure. In such cases secondary sexual characteristics are often inconspicuous. Attempts to fortify the development of the organ by endocrine therapy have, so far as my observations have gone, not met with striking success.

**Atrophy of the testis** is usually unilateral. Commencing bilateral atrophy has to be distinguished from under-development. Atrophy is a term which can be applied to the decrease in the normal bulk of any organ. By atrophy of the testicle is generally understood a concrete clinical entity. The body of the testis shrinks to the size of a bean, while the epididymis usually remains comparatively unaffected. The causes of testicular atrophy are :

1. *As an Aftermath of Epididymo-orchitis*.—Theoretically atrophy can occur after any attack of epididymo-orchitis. In practice it is almost confined to the epididymo-orchitis of mumps (p. 104). This atrophy is a slow, progressive condition which takes months or even years to become absolute.

A patient complained of considerable testicular pain one year after mumps complicated by left epididymo-orchitis. The testicle was commencing to atrophy, and at the time of the examination was about half its normal bulk. I have harboured a belief that atrophy might be prevented by spermatic sympathectomy and tying some of the spermatic veins. The patient declined the experiment.

It is curious that slow certain atrophy—not cicatrization consequent upon sloughing—sometimes follows testicular mumps but is exceptional after other testicular inflammations

2 *Following Torsion*—When treated expectantly if the gangrenous testis escapes bacterial invasion torsion of the testis culminates in aseptic atrophy. Recurrent torsion with spontaneous rectification is another precursor of eventual atrophy. The latter is one of the very few instances where if taken in time the condition can be remedied

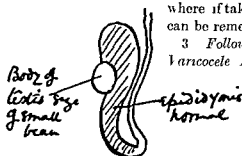


FIG 118—Atrophy of the testis following a war time operation for varicocele. For sixteen years the patient had had intermittent pain in the testicle which had gradually become atrophic. Diagram of specimen removed by operation

3 *Following an Operation for Varicocele Inguinal Herniotomy or Orchiopexy*—The atrophy in these instances is due to accidental division of the spermatic artery

**Hernia**—Of 204 Bassini operations at Heidelberg six instances of atrophy were recorded (Zukschwerdt and Zettle). It is probable that the highest incidence accompanies operations performed in early infancy

**Orchiopexy**—The question of atrophy and orchiopexy has been considered already (p 24)

**Varicocele**.—Atrophy following badly performed operations on war time army recruits accounted for many cases. The specimen illustrated (fig 118) is an example and is further proof that atrophy is sometimes accompanied by pain

#### MALE STERILITY

The causes of male sterility are

- 1 Absence of spermatozoa in the semen (aspermia)
- 2 Oligospermia spermatozoa are few and inactive
- 3 Abnormalities in the transmission apparatus
  - (a) Congenital e.g. hypospadias
  - (b) Acquired e.g. urethral stricture

4. Sexual incompatibility. Breeders have noticed this in mares and stallions.

Childless wedlock is due, in the majority of cases, to the female. Nevertheless, reliable statistics show the male is at fault in about one-sixth of cases.

**Diagnosis.**—Unless there is some obvious cause, such as bilateral testicular atrophy, the first stage is to examine the semen for spermatozoa.

**A Method of Examining for Spermatozoa.**—The specimen obtained fresh by masturbation is collected in a Petri dish taken from an incubator. The dish is returned to the incubator for five minutes, after which the specimen is more fluid and homogeneous. A drop is then placed on a slide, covered with a slip, and examined with a No. 7 objective and a No. 3 eyepiece.

Normally a hundred or more spermatozoa can be seen in the field. Normal motility is straightforward progression across the field in a few seconds. If there are forty or less spermatozoa in the field, and particularly if they are relatively inactive, the patient can be looked upon, for practical purposes, as sterile.

In order to study the morphological characteristics of the spermatozoa, they must be stained. When a specimen of semen has to be kept for staining purposes, a small crystal of thymol added to the fluid semen will preserve it for days.

**Details of the Technique of Staining Spermatozoa.**—(1) Cover a film with 0.25 per cent. aqueous solution of crystal gentian violet for three minutes. (2) Wash with water. (3) Decolorise with 95 per cent. alcohol for a minute. (4) Wash with distilled water. (5) Counter-stain with 1 per cent. aqueous solution of rose bengal for eight seconds. (6) Wash with water and examine under the microscope. The crystal violet colours the nucleus pale blue. The rose bengal causes the protoplasm about the nucleus to stain a reddish colour. The middle piece and the tail are stained faintly.

## ÆTIOLOGY

Aspermia and oligo-spermia are due to :

### 1. *Defects in the testis :*

- (a) Under-development, including maldescent.
- (b) Bilateral atrophy.
- (c) Bilateral disease.
- (d) Prolonged exposure to X-rays.

## 2 *Stenosis of some part of the sperm conducting mechanism*

Most of the defects in the testis have been considered already. By far the commonest cause of stenosis of the sperm conducting mechanism is bygone bilateral epididymo orchitis. Forty five per cent of soldiers in the German Army who had had bilateral gonococcal epididymo orchitis were found to be sterile. When sterility from stenosis is suspected the epididymis and vasa and the vesicle should be palpated carefully. In order to find out if there are yet imprisoned spermatozoa in the testes aspiration of the testis can be carried out.

**Technique of Aspiration of the Testis**—A small area of the scrotum is sterilised and a wheal of local anæsthesia is raised in the scrotal skin. The testis is held firmly against the skin and a rather large bore sterile needle attached to a syringe is plunged into the testis and epididymis. Aspiration is commenced and kept up while the needle is withdrawn slowly. The puncture is sealed. The pain produced is testicular in character but it passes off completely in a short time. The point of the needle is put directly on to a slide and a small portion of the aspirated fluid is expelled. This is covered with a cover slip and examined. Similarly further specimens of aspirated material are submitted to microscopical scrutiny. Spermatozoa when present are few and they are usually feebly motile which refutes the statement often made that spermatozoa are non motile until they have come in contact with prostatic and other secretions. Nevertheless non motile spermatozoa are not as in the case of a condom specimen necessarily dead. M. Hühner found spermatozoa in 45 per cent of cases in which the condom examination repeatedly showed absolute aspermia.

## TREATMENT OF MALE STERILITY

Many cases are quite irremediable. In examples of relative infertility an attempt to render the man in better condition can be made. This follows ordinary common sense principles which include regulating the patient's exercise and diet and giving advice concerning sexual hygiene. When sterility is due to bilateral stenosis of the vasa or epididymes and by testicular aspiration spermatozoa can be demonstrated there is a prospect of remedying the condition by operative means.

**Operative Treatment of Male Sterility**—The first step is to see if the vasa are patent. Each vas is exposed close to the



epididymis and a tiny incision is made in its wall. A strand of silk-worm gut is inserted into its lumen. This is followed

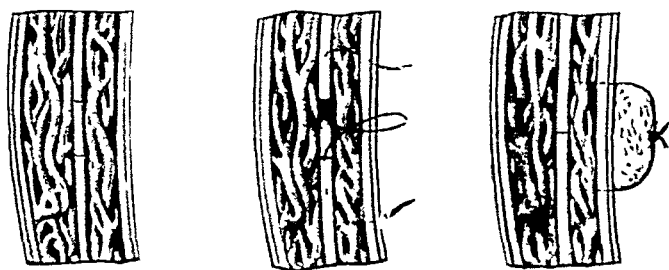


FIG 119 —Method of excision of a stricture of the vas, with end to end anastomosis by means of a strand of silkworm gut (After B W Turner)

by an injection of sterile water coloured by mercurochrome

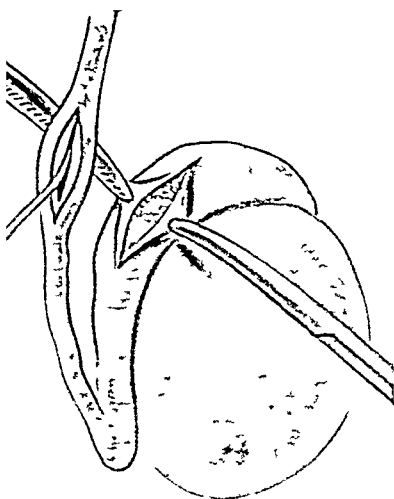


FIG 120 —Hagner's operation (Step I).



FIG 121 —Hagner's operation (Step II)  
The anastomosis is made with fine silver wire

on one side and by a 5 per cent. solution of argyrol on the other, for differential identification. If the injected fluid

comes down the urethra, we know that the vas above the point of injection is patent

**Stenosis of the Vas.**—When a localised nodule is found in the course of a stenosed vas, this may be the principal if not the only, seat of obstruction. The nodule is excised, and portions of the vas are snipped away until there is a patent lumen on each side. Anastomosis is effected with a

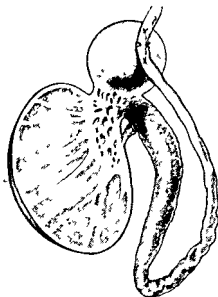


FIG. 122.—In the event of a spermatocele being present the vas can be anastomosed thereto

strand of silk worm gut (fig. 119). The suture is removed on the fourth day.

**Stenosis of the Tail of the Epididymis.**—The tail of the epididymis is the portion most frequently sclerosed after gonococcal infection. It is in this condition that Hagner's operation may be considered. This consists of lateral anastomosis between the head of the epididymis and the unobstructed vas. To see if the vas is patent a strand of silk worm gut is inserted into its lumen towards the seminal

vesicle (fig. 120). It has not yet been explained why the suture material for this anastomosis must be the very finest silver wire (fig. 121). Hagner's only successful cases are where silver wire was used. After anastomoses with fine silk or catgut, no fruitful result has yet been registered.

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## CHAPTER XIX

### REJUVENATION

#### THE STEINACH OPERATION

STEINACH observed that a few weeks after ligation of one or both *vasa deferentia* the appearance and demeanour of elderly rats underwent a change. They became more lively and relished their food, their fur became thicker and regained its gloss (figs 123 and 124), and their apathy towards females was lost. Moreover, these rejuvenated old rats lived longer



FIG 123



FIG 124

An elderly rat before and after vaso ligation (Steinach)

than ones not so treated. Steinach explained this as follows. By ligating the vas gradual atrophy of the spermatogenic tissue ensued. At the same time the interstitial cells of Leydig hypertrophied and increased in number. These interstitial cells manufacture testicular secretion. Steinach calls the interstitial cells the "puberty gland". By vaso ligation, according to Steinach, the "puberty gland" is reawakened. Professor Eugen Steinach, of Vienna, is an experimental physiologist and he has worked upon the subject for many years.

Naturally, it was not long before these suggestive experiments were applied to man, with what results it is almost impossible to gauge. Most scientific observers have been

left unsatisfied as to the claims of this method of rejuvenation in man. On the other hand, P. Schmidt, a great enthusiast, went to Shanghai and operated upon elderly Chinese prisoners, who did not know why or for what the operation was performed. Under these truly scientific premises it is stated that the prison officials and others noted many striking results. At the time of writing vaso-ligature as a means of rejuvenation has been largely given up, at any rate in this country, but it is reappearing in the form of Steinach's second operation as an alleged treatment for hypertrophy of the prostate. This leads us to a consideration of the various technicalities of the procedure.

#### VARIETIES IN TECHNIQUE OF THE STEINACH PROCEDURE

**Method A.**—Under local anæsthesia an incision, which need not be more than  $\frac{3}{4}$  inch long, is made over the cord at the neck of the scrotum. The cord is found and delivered gently. I have found Wayne-Babcock's thyroid forceps extremely well adapted for this purpose; they grasp the cord without tearing any of the radicles of the pampiniform plexus. The vas is then isolated and divided between ligatures. Vaso-ligature by these means is used widely as a preventive of the troublesome complication of epididymo-orchitis following operations on the prostate.

**Method B ("Steinach 2").**—A 2-inch incision is made over each external abdominal ring and the spermatic cord is exposed. By pressure from below, the testicle is brought into the wound and the tunica vaginalis is opened. A strong silk ligature is passed through the digital fossa and is tied so as to occupy the groove between the globus major and the body of the testicle (fig. 125). It is advisable to divide the peritoneal layer so as to deepen this groove before tying the ligature. In this way the vasa efferentia are occluded as they leave the rete testis.

Dr. Paul Niehans, of Clarens, Switzerland, has used this operation as a means of treating prostatic obstruction. It has recently been introduced into England, largely through Sir Henry Lunn, M.D., who was a patient of Dr. Niehans. Apparently this form of vaso-

ligature has resulted in a symptomatic improvement in patients with prostatic hypertrophy but it is not yet possible to estimate whether the results are sufficiently permanent to justify its recommendation. No satisfactory explanation has yet been given as to how the procedure acts. One theory is that by hyperplasia of the puberty gland the prostate diminishes in size but clinical observations do not support this view. Another explanation is that it has been shown in the cat that there is a considerable collection of nerve ganglion cells on the head of the epididymis. It is possible that the ligature around the efferent ducts may involve the ganglion cells and reflexly affect the emptying mechanism of the bladder. Many

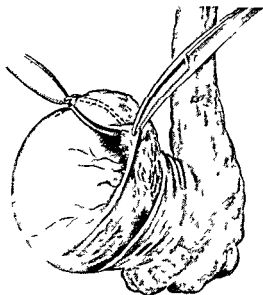


FIG. 193 — Steinach 2 operation

case histories of patients who have benefited by this procedure are now on record. Even with this evidence one cannot be convinced of the therapeutic value of a procedure without a clear scientific basis. One has only to review the current literature soon after the first Steinach procedure was made known to see abundant case histories of the effects of rejuvenation or to go back further when castration was recommended for prostatic hypertrophy to read of similar favourable clinical reports. In spite of these glowing accounts the last procedure has been rightly abandoned as worse than useless for many years and the former is now seldom done for the purpose for which it was designed.

**Method C**—In addition to vasa ligature incisions are made into the tunica albuginea and the testicular parenchyma

which protrudes is excised. According to Steinach, excision of some of the external secretory tissue stimulates the interstitial cells to still further hypertrophy.

**Method D.**—In order to ensure complete isolation of the testis from its efferent ducts epididymectomy is performed (K. Sands).

### TESTICULAR GRAFTING

That some beneficial results may accrue from testicular grafting are more understandable than in the case of the former procedure. To any workers in this field two difficulties are soon apparent :

1. The supply of donors is limited.
2. The graft eventually perishes.

Voronoff claims that the graft lives for years if correctly applied by his technique, which is as follows. *The donor* is preferably a healthy young chimpanzee ; invariably a blood test for spirochaetosis should be performed before pronouncing the animal healthy. The least time possible should be taken in effecting the transplantation. To this end an assistant is employed to remove aseptically a testicle from the donor, and to cut away the useless epididymis. The shaping of the graft is done by the surgeon, who, in order to minimise the time expended in the transfer, prepares in advance for the reception of the graft.

**Preparation of the Bed for the Graft in the Recipient's Tunica Vaginalis.**—Each testicle is delivered through a suitable incision in the scrotum. The tunica vaginalis is opened, and when all is in readiness for the application of the graft, the visceral surface of the tunica vaginalis is lightly scarified with a needle (fig. 126).

**Shaping of the Graft.**—The testicle is cut so as to obtain four wedge-shaped slices like those from a melon (fig. 127). The sharp edge of the melon slice is trimmed flat with scissors, so as to leave a thickness of about 1 cm. The tunica albuginea of the simian graft is scarified in order to facilitate subsequent nutrition of the underlying cells.

**Application of the Graft.**—Two grafts are implanted

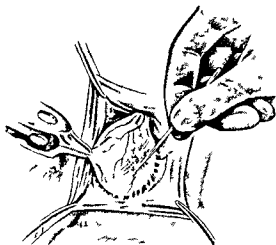


FIG 126—Scarification of the visceral layer of the tunica vaginalis in preparation for the application of the graft (After Voronoff)

upon each tunica vaginalis and fixed in position by sutures

(fig 128) The parietal layer of the tunica is stitched and the scrotal wound closed. According to Voronoff three months must elapse before any beneficial effects can be expected.

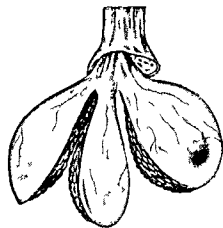


FIG 127—Splitting the testicle into melon slice sections. The portion on the right will be divided into two thus making four grafts.

Other workers have placed grafts in the sheath of the rectus abdominis or in the perirenal space. At first sight it would seem that the latter situations are perhaps better suited for the

reception of the graft until we remember the peculiar



reluctance of testicular tissue to develop unless it is housed in the scrotum (p. 6). Nevertheless, the thermo-regulating mechanism appertains mainly to spermatogenesis, and it is not proven that beds other than the tunica vaginalis are less suitable for the reception of the grafts.

Grafts from man to man are occasionally possible. Excised maldescended testes have been used for this purpose. With the development of

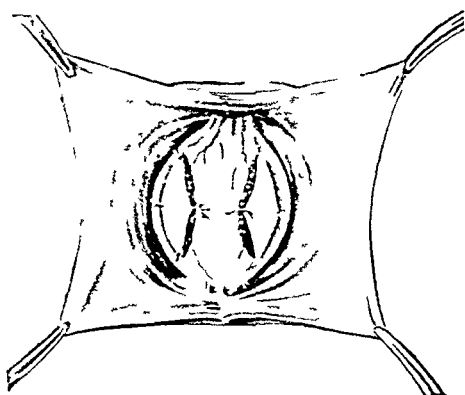


FIG. 128 —Two grafts attached to scarified areas on the tunica vaginalis (After Voronoff.)

successful orchiopexy, the coincidence of having a donor and a recipient under observation at the same time should be remote



FIG. 129 —Before and some months after testicular grafting. (Voronoff.)

The possibility of improving the well-being and mental agility of elderly, though otherwise healthy, men by increasing their supply of testicular hormone is not unpromising (fig. 129). None of the operations requires a high degree

of surgical judgment or technical skill. Consequently there has been a tendency for them to have been performed by a type of practitioner who is not above advertising to the lay public. Rejuvenation is a subject which lends itself to arresting newspaper copy. True progress has been retarded by extravagant claims and publicity in the lay press.

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